AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION

VOLUME 24 NEW YORK AND LONDON NUMBER 52

Published at 218 William St., New York, every Thursday by the

American Machinist Press.

[INCORPORATED.]

Also published at 34 Norfolk St., Strand, London, W. C.

Correspondence on mechanical subjects solicited. Name and address must always be given—not necessarily for publication.

Address all business communications to the American Machinist Press. Matter for reading columns may be addressed to the Editor.

Subscribers can have address changed at will. Give old and new addresses. Date on wrapper denotes end of month in which subscription expires.

Subscription Price:

$4 per year, postage prepaid, to any post office in the world. No back numbers beyond current year. For sale by newsdealers, generally.

European subscriptions served by the AMERICAN MACHINIST CO., LTD., 34 Norfolk St., Strand, London, W. C.

Entered at New York P. O. as mail matter of the second class.

Cable address, "MACHINIST," N. Y. Lieber's and A B C Codes.

By an awkward transposition of words we were made to say last week in speaking of the arrangement of the paper for 1902, that "This plan will allow the London office to arrange their reading matter on consecutive pages, with the American reading matter on consecutive pages, and their advertising with the American advertising."

What we meant to say was this: "This plan will allow the London office to arrange their reading matter on consecutive pages with the American reading matter, and their advertising on consecutive pages with the American advertising."

For the Better Adjustment of the Industrial Machine.

On another page we give an account, as extended as the numerous claims upon our space will permit, of the convention recently held in this city and attended by authorized representatives of capital and labor and of the community at large, under the impulse and auspices of the National Civic Federation. Any report of the proceedings must necessarily tell of what was said rather than of what was done, as practically nothing was done but the narrating of experience and the voicing of opinion, and many of the utterances were so familiar and conversational as scarcely to be assigned the dignity of speeches. They were not therefore of less weight, but generally of much greater weight, and must be accepted as being generally impelled by greater sincerity and carrying more truth than if they had been more studied and formed. In one respect there was on both sides, so far as there may be said to have been two sides, great uniformity of opinion in one vital particular, and that was as to the desirability and the efficacy of free and full interchange of thought and a complete understanding of each other's rights, purposes and prospects. The position of the labor organizations was more clearly and satisfactorily defined than has been usual. There was from no labor representative any slightest hint of discontinuing organized action, but there were from many of them acknowledgements of the general futility of the strike. The disastrous consequences accompanying every conflict being appreciated quite as fully by the employers also, and the avowed purpose of both capital and labor being to avoid unavailing antagonisms, the committee of strong men which was appointed as the outcome of the convention should hope to be able to accomplish most beneficent results.

While we must look upon what was done as a step in the right direction, we must still regard it as only a step. It is a curious thing that all our schemes thus far in this line have to do with trouble and conflicts. When we are not planning to patch up and cure a breaking out in one place we are scheming to prevent one somewhere else, always assuming that those disturbances inherently attach to the industrial system. It is like a lot of mechanics getting together and consulting as to the reconstruction of a plant of machinery that is continually breaking down or doing bad work. It is not after all reconstruction that is essential, but a better building farther back, a more correct preliminary construction and arrangement, so that continual patching and reconstruction will not be required.

But such reconstruction of the industrial, or what is nearly the same, the social machine seems unlikely to take place even if it could be shown to be desirable, and no other way seems to be practicable but to go on patching. Of the sincerity of most of the men taking part in the proceedings there can be no doubt whatever, though it is to be remembered that they were considering things in general and in the abstract, and somehow when men come up against concrete examples affecting their own interests in what they conceive to be a vital manner they are apt too often to set aside entirely their previously expressed ideas and exhibit very little willingness to do anything toward bringing about the conditions they profess to so much desire. Nevertheless, the effect of this conference can hardly help being for good, and we shall hope to hear of greater good resulting from the labors of its committee.

The Decimal System for Numbering Working Drawings.

The article which we publish under this title in another column deserves more than a passing notice. The system described is such a radical innovation that it would perhaps be rash to endorse it in advance of trial, as trial of such systems always develops features and often difficulties and objections that cannot be foreseen. It so happens, however, that while the manuscript of this article was being prepared for the printer, knowledge came to us of three bicycle factories in which it is in use and of another case in which a man of lifelong experience with locomotives and their manufacture, as well as with filing and indexing large masses of information and with the Dewey Decimal System as applied to libraries, had developed the system described for use in a locomotive works. In this case the system had not been put into use, but this man fully believes it preferable to any in use in that field of work.

As applied to libraries the system has practically taken possession of the field, and we can, in advance, see no reason why it should not be equally applicable to the drawing office.

The commanding advantage of the system lies in its flexibility and indefinite expansibility. Moreover, this expansibilty may be, and naturally is, a matter of growth. As the material to be filed grows in volume and more minute classification becomes desirable, it can be made without in any way interfering with the classification already in use. Moreover, this more minute classification may take any direction desired, being minute in such directions as desired and remaining general only in those directions in which general classification is sufficient.

The fact that the plan proposed is a radical departure from those in common use, is no reason for dismissing it as impracticable. It was an equally radical departure when first proposed for libraries and it may prove to be exactly the thing needed for drawing offices as it already has for libraries.

An unusually disastrous boiler explosion occurred, December 20, at the Black Diamond Steel Works, Pittsburgh, Pa. Four boilers seem to have burst simultaneously, wrecking the mill building and also the boiler works of James McNeil adjoining, the known dead at this writing being five, with several others supposed to be in the ruins and a long list of wounded. One of the boilers went clean through the mill and the boiler shop, another boiler went through the roof, across a street and through a house to the cellar. The other two boilers went all to pieces and caused most of the destruction of the buildings. This catastrophe, following so closely that at the Penberthy Injector works, forms a strong argument and advertisement for the water-tube boiler, which by no combination of circumstances is able to do such destructive work. The boilers in the two cases referred to were probably as well looked after as it can be hoped that boilers generally will be, and it seems as though it is practically impossible to entirely avoid such explosions.

A Capital and Labor Convention.

In the rooms of the Board of Trade and Transportation in this city there was held last week, under the auspices of the National Civic Federation, a convention of national, if not international, importance and interest having to do with the rights and the reciprocal interests, duties and prospects of employers and employees in their relations to each other and in their necessary collaboration in doing the world's work. The purpose of the convention was of course to consider the causes of the antagonisms and derangements which occur among or between the planners and the doers of the world's work, and to devise or propose means and methods for securing smoother running of the industrial machine. The convention was large enough to include, as it did include, the ablest and most fitting and responsible representatives of the different interests to be reconciled. It was considered that capital was represented to the extent of more than a thousand millions of dollars and that more than a million of workers for daily wages also had their able and authorized spokesmen, while the community at large and its interests were also ably and honorably represented. The importance of the convention and the possibilities in its grasp for promoting the welfare of the people at large were evidenced in the full reports of the meetings which were given in the daily press. Space will permit us only to very briefly hint at what was said by the various speakers.

Oscar S. Straus, ex-Minister to Turkey, called the meeting to order and gave a starting direction to the deliberations in a short address. He said that most of the misery of the world results from ignorance and most of the remainder from passion, and that a large share of the troubles between capital and labor were due to these causes. Organization and consultation should pave the way to a better understanding of reciprocal rights and promote the necessary reciprocal concessions.

Bishop Potter said that the growth of intelligent scrutiny of the industrial problems of the day was the most interesting and most promising note with reference to the future. He hoped that the convention would seek to bring back the humane in the relations between capital and labor and to establish more points of contact between the two. The misery of modern industrial life is in the isolation it entails. When you get a great body of men who know nothing of each other you have the germ of evils. A labor organization gets its members into a room and they are harangued by nobody but the men who look exclusively at their side of the problem, and capitalists on the other hand do precisely the same thing. Instead of this, to "put yourself in his place" should be the motto and aim.

Chairman Straus read a newspaper extract containing a statement as follows attributed to Senator Hanna:

"I would rather have the credit of making successful the movement to bring labor and capital into closer relations of confidence and reliance than to be President of the United States. If by resigning my seat in the United States Senate I could bring to fruition the plans that we are now fostering to make strikes, lockouts and great labor disputes impossible I would gladly do so." The Senator said that those were precisely his sentiments. He told of his first conference with the representatives of dissatisfied employees, when he told them that if they actually meant what they said in the paper presented he was emphatically with them, and that he immediately took up the operators' side of the question.

Archbishop Ireland said that he knows the employers' ideas in this country and that they are human. He had never met a capitalist that has thought that man, whoever he might be, was a piece of machinery. On the other hand, he had never met the workingman who on sober thought would not acknowledge that his arms are of no account to earn a livelihood unless assisted and directed by the leaders of industry.

John Phillips, secretary of the Hatters' Union, the first labor leader to speak, said that the workingmen whom he represented had come to the conclusion that "there is nothing in strikes."

Representative Donnelly said for the bricklayers that the troubles between them and their employees could in nearly all cases have been settled by arbitration.

James Ryan, of the Photo-Engravers' Union, maintained that labor unions had been of great benefit to workingmen, improving them morally, socially and financially.

Charles M. Schwab, president of the Steel Trust, and introduced to the convention as "the greatest example of rise from the ranks of labor in this country," said that while the prosperity of the United States must advance rapidly in any event, it will be more rapid when a happy solution of the labor troubles is reached. Labor unions would never succeed, as trusts have never succeeded, in the attempt to restrict the output or to put any restriction upon trade in general. A trust will only succeed where there are motives of consolidation for economy's sake, and the laborer must take a similar position. Every labor organization that he had known has had for its foundation the restriction of the output. Employers are not opposed to labor organizations which keep their contracts, who will not restrict the output and who have the good of their trade at heart.

Many labor representatives were unable to be present at the first day's session on account of railroad delays; these mostly therefore had their innings on the second.

E. D. Durand, secretary of the National Industrial Commission, said that one thing necessary in promoting industrial peace is a *large* representation when conferences occur.

F. P. Sargent, grand master of the Locomotive Firemen, maintained that since 1873 organization among the locomotive firemen had doubled the wages and had been the means of securing to the men their just deserts, but that this had been done by friendly talk and not by the use of strikes.

Lewis Nixon, the shipbuilder, said that the industrial and commercial development of the United States in the past twenty years has been because the employer in this country works with the men who work for him. All are workers and all have rights, and we are about to establish a kind of industrial clearing house where grievances on either side can be discussed and weighed, and with the benefit of informal public opinion justice will prevail. One of the troubles in labor organizations here is that abuses which have grown up in foreign countries under other conditions have been brought in. The American workman, while courageous enough to stand up for his rights, is also courageous and intelligent enough to know and acknowledge when he is wrong.

O. M. Eaton, of the Shoe Workers' Association, spoke of the vast increase in production by the use of machinery, and the accompanying advance in the earnings of the workers. He spoke of many labor troubles which had been amicably settled by friendly talk, and many in his line now make yearly contracts with their men, when there is little prospect of disputes arising.

Samuel Gompers, president of the American Federation of Labor, spoke at considerable length. He said that he had

not joined and would not join in the cry against combinations of capital, but he did object to such combinations attempting to interfere with the political affairs of our country, and especially with the judiciary. He welcomed the organization of the employers and he would perfect and complete the organization of the wage earners, and he would have them meet and discuss wages and hours of labor and conditions of employment with the result of uplifting the human family commensurately with the industrial and commercial success of our country.

John Mitchell, president of the United Mine Workers, said that he had never seen a strike which could not have been averted if the employers and the men had met in conference. If the men who have been interested in this movement will give as much time and effort to it as the labor men have given to their particular branches of industry, then before a year shall have passed results will be evident and strikes and lockouts will be reduced to a minimum.

Archbishop Ireland said: "This shall be the glory of America, that we recognize justice for all, rights for all. In America we do not hope for the salvation of society by strong governments, by armies or navies. We hope for peace and prosperity and social happiness from the manhood of the country. It is this manhood that has here spoken, and because of it I feel more confident than ever I have felt in the great democracy of America, in the great and glorious republic of which we are so proud to be the citizens. Let no one go on the executive committee whose heart does not thrill with the sentiments of justice and charity which have here found expression; let each one feel the great responsibility upon him of bringing justice to all, of bringing peace to all, of guarding the poor from peril of oppression and of guarding the rich from the greater peril yet of even giving a shadow of oppression to their fellow-men."

The formal action of the convention consisted in the naming of a permanent committee comprising twelve representative capitalists and employers, twelve representatives of organized labor and twelve presumably neutral from the community at large. It is not necessary here to reproduce the list, as it has appeared in hundreds of newspapers. The committee chose permanent officers from its number as follows: Chairman, Senator Hanna; vice-chairmen, Samuel Gompers and Oscar S. Straus; treasurer, Charles A. Moore; secretary, Ralph M. Easley.

The following statement of the purposes and plans of the committee was given out:

"This committee shall be known as the Industrial Department of the National Civic Asociation.

"The scope and province of this department shall be to do what may seem best to promote industrial peace; to be helpful in establishing rightful relations between employers and workers; by its good offices to endeavor to obviate and prevent strikes and lockouts; to aid in renewing industrial relations where a rupture has occurred.

"That at all times representatives of employers and workers, organized or unorganized, should confer for the adjustment of differences or disputes before an acute stage is reached and thus avoid or minimize the number of strikes or lockouts.

"That mutual agreements as to conditions under which labor shall be performed should be encouraged, and that when agreements are made the terms thereof should be faithfully adhered to both in letter and spirit by both parties.

"This department, either as a whole or a sub-committe by it appointed, shall, when requested, act as a forum to adjust and decide upon questions at issue between workers and their employers, provided, in its opinion, the subject is one of sufficient importance.

"This department will not consider abstract industrial problems.

"This department assumes no powers of arbitration unless such powers be conferred by both parties to a dispute."

Commercial Review.

NEW YORK, Saturday Dec. 21.

Events of the moment as the holidays approach are of relatively little importance in gaging the mechanical lines of trade. More or less delay in business is natural at this season in many lines, while in others, such as power transmission supplies, there is a spurt of activity owing to preparations for repairs during the few days at the end of the year when many mills are closed down. Whether next year will show an expansion beyond the limits of the present one is a live question to which there is no visible ground for a negative answer, but an answer must not be called for as of right before the first of February. The future will be in part determined by what the past has been. When—as is pointed out—industrial concerns come to balance up their books for the year, if they find as satisfactory a showing as they have expected they will be encouraged to a free hand in improvements, but if the result proves disappointing they will be disposed to caution hereafter.

The feature of business is the sensational collapse in metals leaving such debris as appears in our quotations this week. A member of a metal-trading firm to-day spoke very bitterly of the manipulation which had brought it about. This he pronounced cruel on the part of the big operators and intimated that it meant the ruination of business for many smaller people for the next year. Added to the demoralization in copper has come the failure of a firm of speculators in London, which disaster has played havoc with tin and has depressed Scotch iron warrants abroad. The strength of the American iron situation will probably keep the sympathetic movement in the lesser metals here from extending to iron and steel. In fact, steel prices in some quarters are inclined to greater strength. The curtailment of production through the destruction of the Black Diamond plant in Pittsburgh by an explosion is conducive to this result. Among the metals which have gone down in the general crash is lead, which is now quoted at 4c. in a large wholesale way, as compared with 4⅜c. at which it has been held for many months past.

The tube mills either in existence or building in this country outside of the National Tube Company are said to have a combined production greater than the output of the National Tube Company, which latter is estimated at 2,500 tons a day. It is expected that this competition will have the effect of reducing prices before very long.

The emery and other abrasive wheel manufacturers recently held a meeting in Buffalo which is said to have been more than usually successful in securing an approximately complete representation of the trade and to have resulted in an understanding as a result of which a new price list is expected to make its appearance and to take effect about April 1.

Mitts & Merrill, Saginaw, Mich., recently shipped the British Westinghouse Electric & Manufacturing Company, Manchester, England, five large keyseating machines. Mitts & Merrill are very much crowded with business in this line. They have their new foundry nearly finished and will extend their machine shop into the old foundry, practically doubling their capacity.

The Allis-Chalmers Company has a contract on hand for two 750 horse-power upright engines for the Fairhaven & Westville electric road, New Haven, Conn.

The equipment of an automobile plant was recently offered for sale. The cause does not, however, appear to have been financial failure, but internal disagreement.

A few weeks ago we mentioned that Sir Christopher Furness, the great English shipbuilder, who was leaving for home after a visit to the United States, was interested in a new shipbuilding project in this country. Subsequent news gives reason to believe that this plant will be located on the Canadian Sault Ste. Marie and that it will be the largest along the Great Lakes.

Competition in steel car building is greatly on the increase. A new company—the Standard Steel Car Company—has been formed in Pittsburgh with an initial capital of $2,000,000. J. M.Hansen, chief engineer of the Pressed Steel Car Company, will be president, and it is intimated that C. T. Shoen, who is said to have withdrawn from the latter company, will be financially interested. The new concern is to have a normal capacity of 50 and maximum of 65 cars a day. Contracts for

buildings and machinery have already been awarded.

The Jessop Steel Company, of Washington, Pa., with $250,000 of British and American capital, has been incorporated under the laws of Pennsylvania to build and carry on the new works which Wm. Jessop & Sons, of England, are establishing there. The directors are: William Jessop, president of Wm. Jessop & Sons, Sheffield; Sydney J. Robinson, managing director of the same; Herbert Hughes, secretary of the Sheffield Chamber of Commerce, also a director of the British Jessop company; W. F. Wagner, the general manager of the New York offices of the British company; E. L. Hand, of Philadelphia, and C. N. Brady, of Washington, Pa. The officers will be William Jessop president, Mr. Robinson vice-president, and James Jessop secretary and treasurer. The initial plant will consist of three main buildings—a crucible melting shop 225x110 feet, rolling mill 275x110 feet and a power house 100x60 feet. The company proposes at first to devote its attention to the manufacture of sheet steel. The works will be designed by James J. Mahon, of Chicago, through whom the contracts for the construction and equipment of the plant are being given out. The rolling-mill machinery will be supplied by the G. A. Hogg Company, of Pittsburgh. The engines—one 28x72, another 24x60—will be built by the Lane & Bodley Company, of Cincinnati, Ohio, and the water-tube boilers by the Babcock & Wilcox Company, of New York city. Contracts for machine tools, cranes, etc., have not yet been placed.

The H. W. Johns Manufacturing Company, of New York, and Manville Covering Company, of Milwaukee, have consolidated under the title H. W. Johns-Manville Company, with a capital stock of $3,000,000. We believe that the relations between these companies have been close for some time past.

It is complained, and with justice, that the United States is not getting its share of South American trade, which seems to be because she is too busy elsewhere to make a serious attempt to secure it. The other side of the case is shown in an official report from the Peruvian commercial city of Trujillo, which we translate from the "Deutsche Metall-Industrie Zeitung": "The importation of German industrial productions has increased, but up-to-date statistics are lacking. It is moreover unavoidably necessary that German manufacturers and export houses devote themselves more than formerly to meeting foreign competition. Beautiful catalogs, big bright placards, and constant advertisements in local papers are the suitable means to this end. In machines, especially locomotives, the manufacturers of the United States are getting ahead of the German ones; also in machinery for rice, coffee and the like, cocoa presses, plows and agricultural implements and tools. . . . The coasting steamer traffic offers a profitable field for small steamers, which must, however, sail under the Peruvian flag in order to enjoy port privileges, etc."

We have received from Deputy United States Consul-General Simon W. Hanauer, of Frankfort-on-Main, Germany, the following: "The Director-General of Bavarian Railroads (which are owned by the State) has now purchased the right to manufacture the Vauclain system locomotives, an American patented invention. The Bavarian Government about nine months ago purchased of the Baldwin works at Philadelphia two of these Vauclain locomotives, which since then have been running and fully tested on Bavarian roads. The result has been highly satisfactory in every way. The government will now have machines built on this system at Bavarian locomotive works of Maffei and of Krause & Co. It is estimated that the Bavarian-built machines—with some trifling changes in the construction—will cost about 20,000 marks more than those furnished by the Baldwin works of Philadelphia. The adoption of this system by the Bavarian Government will no doubt induce other German and European governments to introduce it on their roads."

In another letter Mr. Hanauer informs us that against strong competition a German firm, August Klönne, at Düsseldorf, has secured a contract from the municipality of Amsterdam, Holland, for a gasometer 65 meters high and of 100,000 cubic meters capacity. The cost of construction will be about 1,000,000 marks ($238,000). The choice is said to have been based upon the peculiar design submitted and German industrial circles are elated over the decision.

CHICAGO MACHINERY MARKET.

Present trading in iron-working machine tools is largely of a pick-up order. An occasional transaction running up toward $5,000 is heard of, but the generality of the business is for one, two or three machines the value being $1,000 or less. And trade of that character is fairly brisk. The buying is widely scattered, extending throughout the entire West. One transaction during the past few days was the purchase of a machine-tool equipment from John W. Dawson by the J. B. Draper Machine Company, Seattle, Wash. The packing houses have been making lately the same extensions in their machine shop equipments as in other departments, and some fairly good business has been closed in that direction. Armour & Co. and Nelson Morris have placed good orders with J. B. Doan & Co. and others.

For iron-working machine tools, December trade is tapering off to a timely quietude, as the month and the year draw to a close, but for wood-working machine tools there seems to be little slackening of demand, even to the verge of holiday work. Regarding the wood-working tool trade as a whole in this territory for the year now ending, it has exceeded by from 50 to 100 per cent. the very satisfactory trade of 1900. The machinery stocks here which have been badly broken for months are not improving. There is sometimes among the representatives of builders a disposition to avoid rather than seek the trade that is current, especially the large orders, because of an inability to handle the business. In the wood-working machine-tool line December was the best month of 1900. This year December is running about the same as a year ago, though it has been surpassed by several previous months this year. The iron-working tool trade has also exceeded that of 1900, though less notably.

Small or medium-sized iron-working tools are abundant and orders secure prompt shipment, but for some of the larger tools there are delays. Planers and shapers are scarce and often cannot be obtained within three or four months' time. The purchaser last week of a special milling expected delivery in about three months. That is ample time for the construction of the tool, but this purchaser was surprised to find the best time he could obtain was eight months. And for special machinery in general that is the common condition of trade. The builders have their shop capacities well engaged.

Quotations.

NEW YORK, Saturday, Dec. 21.

Pennsylvania Foundry Pig Iron, Jersey City delivery:

No. 1 X	$16 65 @ $17 15
No. 2 X	16 15 @ 16 65
No. 2 plain	15 65 @ 16 15
Gray forge	15 00 @ 15 25

Alabama Pig, New York delivery:

No. 1 Foundry or soft	15 75 @ 16 50
No. 2 foundry, or soft	15 25 @ 15 75
No. 3 foundry	14 75 @ 15 25
Foundry forge, or No. 4	14 25 @ 14 75

Bar Iron—Base sizes—Refined brands, mill price on dock, 1.68c. in carload lots. From store, 1.90 @ 1.95c. in small lots.

Tool Steel—Base sizes—Good standard quality, 7c.; extra grades, 10c. and upward.

Machinery Steel—Base sizes—1.90 @ 2.00c. from store.

Cold Rolled Steel Shafting—Base sizes—From store, 2¼ @ 2½c.

Copper—Lake ingot nominally 13c., but believed to be obtainable as low as 12c.; electrolytic, 12⅞c.; casting, 12½c.

Pig Tin—In 5- and 10-ton lots f. o. b., New York, 23c.

Pig Lead—For wholesale lots, 4c., with .02½ @ .05c. extra for carloads.

Spelter—4.30 @ 4.45c., New York delivery.

Antimony—Cookson's, 10¼ @ 10½c.; Hallett's and U. S., 8¼ @ 8⅝c.; Italian, 7¾ @ 8c.

Lard Oil—Prime City, 81 @ 82c., in wholesale lots.

The prices of metals generally are so demoralized as to be extremely uncertain.

A Good Catalog File.

We found on a recent visit a good many interesting and good things about the establishment of the W. P. Davis Machine Company, at Rochester, N. Y., which is one that combines the features of a machinery store and a machine shop. On the ground floor of the building and in the basement a large stock of machinery and supplies is carried, not of course the machines made by Mr. Davis only, but all sorts of machine tools by a great variety of makers. The upper floors are devoted to machine-shop purposes, and here are made the engine lathe and other tools with which their name is associated and the new coupling which we illustrated at page 978.

Among the other things that seem to possess special merit may be noticed the catalog file in the office, which is illustrated herewith and which seems to possess the very desirable features of simplicity, convenience, elasticity and moderate cost. The shelves, which are adjustable, have in their upper surfaces holes into which are fitted wire partitions of a form shown by Fig. 2. The holes are placed one inch apart along the shelves, and so these wire partitions may be shifted in steps of one inch to any required spacing. By means of two strips of suitably formed molding, the outer edges of the shelves are adapted to receive and hold small pieces of cardboard on which numbers are written, and these numbers, which are in rotation, are found under the catalog of the corresponding number. Any desired catalog is thus easily picked out or replaced in its proper location.

CATALOG FILE IN OFFICE OF W. P. DAVIS MACHINE COMPANY, ROCHESTER, N. Y.

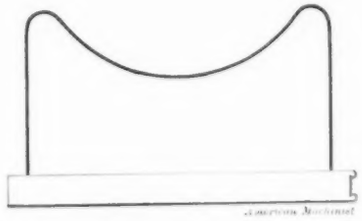


FIG. 2. WIRE PARTITION AND END VIEW OF SHELF.

There are two drawers used with the index. One gives the name of the article wanted and the other gives the name of the maker of the different articles, so that if one forgets the name of the manufacturer he can look up the article from its name, and the folding shelf on the inside of the right-hand door serves an obviously useful purpose. Besides its other good points Mr. Davis says he had it made by a local concern at a very reasonable cost. It is of oak, well finished and an excellent job throughout.

Confusing Definitions of Iron and Steel.

From the chemical standpoint steel has been defined as that compound of iron which contains a certain amount of carbon, and it is particularly distinguished by its property of attaining great hardness by sudden cooling from a high temperature. Iron, on the other hand, is that ferrous compound which contains a smaller quantity of carbon, but cannot be hardened by tempering. On the basis of this definition some untempered steels may be no harder than iron.

The two names have been used to distinguish the metal which is produced as a spongy mass, and has immediately to be subjected to working to expel the slag, etc., from that which is produced in a fluid condition and requires no working, except to transform it from a solid mass into plates and bars and other useful forms. This use of the names is very widespread. Mr. Gruner has, however, objected to it on the ground that it is irrational to distinguish two materials by the methods of production without reference to the chemical composition.

The distinction between iron and steel may be based on the property of the metals as regards hardening by tempering, that being considered as steel which is capable of being tempered, and that as iron which cannot be tempered. The objection to this is that some modern steels, containing other elements besides carbon and iron, are made softer and not harder by sudden cooling.

The fourth method of separating steels from irons is by the tensile strength, that above a certain strength being denominated steel, and that below this value as iron. This has been suggested by German authorities, but appears to be the most artificial of all.—"American Manufacturer." Translation from *Baumaterialienkunde*.

Industria Betterment Reaches Russia.

In the foreign correspondence of the New York "Times" we find the following:

"A practical application of advanced theories has recently been made in a cotton factory near Moscow. Three years ago the proprietor of this factory abandoned it in payment of a mortgage due to the Imperial Bank of Russia. The governor of the bank then entrusted to a young engineer the task of reorganizing the establishment on a new basis.

"The eight-hour day was introduced, and, to the great surprise of the authorities, gave excellent results. There was a steady increase in production, while, at the same time, the number of accidents decreased in a noteworthy manner.

"A hundred of the more intelligent workingmen—that is to say, one-half of the employees—have recently received a

share in the profits, the result of which has been an increased production of 15 per cent. The engineer-director has now established a co-operative society for feeding and clothing the employees."

Experiments on the Flexure of Beams—Discovery of New Laws—III.

BY ALBERT E. GUY.

EXPERIMENTS (CONTINUED).

When the beam starts to buckle it assumes at once a characteristic shape which is accentuated as the load is gradually increased. The well-known parabolic curve due to the bending lies in a vertical plane, while that due to buckling, as viewed from above is S-shaped, as represented in Fig. 2. This peculiar form is very misleading, and the author, noticing it in many of his experiments, came to the conclusion that it was a double curve, and he was at a loss to explain its non-appearance as such when the length of the beam between supports was very small. However, after very careful trials, it was found that in short beams requiring a heavy load to cause the buckling, the rigidity was very great and the lateral curve assumed was like an arc of circle, whereas in long beams, easily buckled, the rigidity was very small and the arc-like curve assumed at the beginning of the buckling was quickly distorted into the shape shown in Fig. 2, as the load increased appreciably. Moreover, with beams of I and T sections, the S curve was more difficult to obtain owing to the greater rigidity.

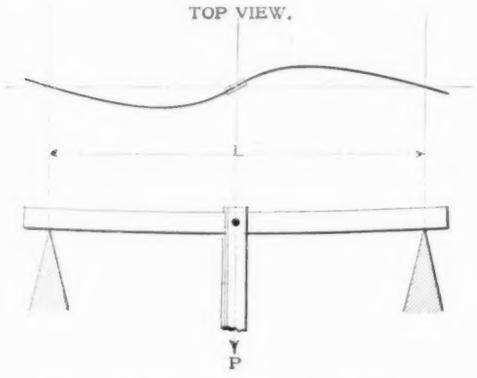


FIG. 2. FAILURE OF A BEAM BY BUCKLING.

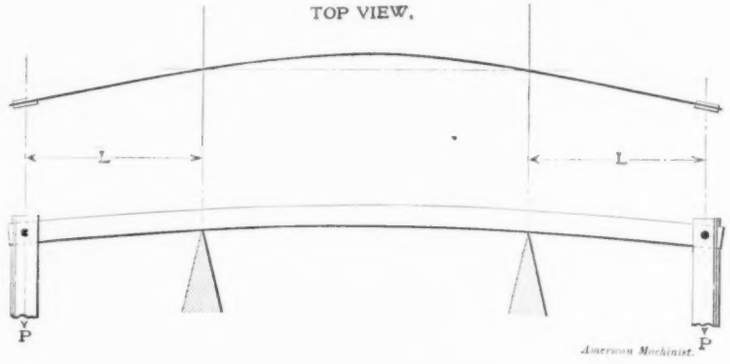


FIG. 3. FAILURE OF AN OVERHUNG BEAM.

The contraflexure at the center of the beam is caused principally, as will be seen later, by the guiding due to the suspension strips fastened to the beam and through which the load is transmitted. Thus, when this double curve manifests itself, it is still possible to increase the load by about one-half before the elastic equilibrium of the beam is destroyed, because the new shape of the beam increases its static equilibrium. This explains why the recorded loads for the plain rectangular sectioned beams are so much in excess, relatively, of those applied on the I beams. (The exact manner in which all the experiments were conducted will be fully explained later.)

In another series of experiments in which a bar was supported horizontally at two points equally distant from the ends, and equal weights were applied at the ends, it gave way also by buckling, but the resultant curve, lying horizontally, was in the form of an arc of circle, as shown in Fig. 3. Here we have a single curve when the ends of the beam are free to move under the action of the load, while in the first case the ends were held on the supports by the friction due to the load. The deformations of the beam, as stated above, as well as the consideration of formula (14) modified as follows:

$$P = K\frac{I}{L^2} = \frac{\text{constant} \times I}{L^2}, \quad (15)$$

where $K = \frac{P_1 L_1^2}{I_1}$, point to a similarity of effects between those produced in a beam by direct bending and those due to an axial thrust causing lateral bending (case of a column loaded on end). This lateral bending distorts a strut differently according to the manner in which the strut is supported. For instance, if a solid is fixed at one end and loaded axially at the other, the resulting curve has half a bend, while that which results when the solid is only supported instead of fixed at one end has one. In Fig. 4 are represented struts supported or held in various manners, and if the curve assumed at B is taken as a standard of comparison we see that at A the curve has ½ bend, at C the curve has 1½ bends, and at D the curve has 2 bends.

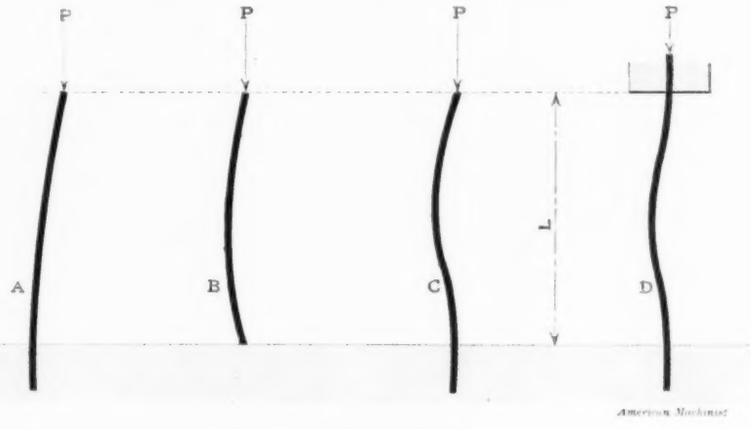


FIG. 4. FAILURE OF STRUTS.

These curves analysed by Euler are said to be sinussoidal arcs, though it can be proved that they are only approximately such; their theory is exposed in advanced treatises on Applied Mechanics. Professor W. C. Unwin treats of the compression of long bars in a clear and concise manner in his "Elements of Machine Design," Vol. 1, section 38, from which the author begs to quote the following: ". . . If, however, the bar is of great length it gives way ultimately under the action of a thrust by lateral bending; the stress at the section where the fracture occurs being a compound stress, due both to the longitudinal pressure and the curvature of the bar. Rules for the ultimate resistance of long bars to compression were first obtained theoretically by Euler and experimentally by Professor Hodgkinson. Hodgkinson's formulas have been generally used in this country (England) in designing compression bars. These rules are inconvenient in form, and they can only be extended to many cases of common occurrence by theoretical assumptions, which are only approximately true. An expression more convenient in form than Hodgkinson's was proposed by Tredgold, revised by Gordon, and afterwards modified by Rankine, so as to be applicable to bars of all forms of section. The reason-

ing on which this rule is based is, however, not satisfactory. All these rules are intended to give the ultimate strength of the bars, and in applying them it is necessary to divide the resistance thus calculated by an arbitrary factor of safety. Actual compression bars are not intended to be loaded beyond their elastic limit, and hence it may be urged, with reason, *that the theoretical formulas of Euler, which Hodgkinson discarded as not agreeing with his experiments on ultimate strength, are more strictly applicable to the circumstances in which long compression bars are used than Hodgkinson's rules.* They are simpler and include all cases. Euler's rules assume the bar to be initially straight and homogeneous, the load axial and the elasticity to be unimpaired with the great est load. In that case no increase of the load would directly cause bending, but a point is reached at which the equilibrium of the bar becomes unstable. With less loads the bar, if slightly bent temporarily, will restore itself to straightness. With greater loads, if any flexure is produced, however slight, the bar will not restore itself to straightness, but the bending will increase under the action of the load till the bar breaks. . . . ."

The general formula, due to Euler,

$$P_0 = \frac{n^2 \pi^2 E I_0}{L_0^2}, \qquad (16)$$

shows that when a straight bar of length L_0, supported or held at one end is loaded axially at the other, its equilibrium becomes unstable when the value of the load P_0 is equal to a constant factor ($\pi^2 E$) multiplied by the least moment of inertia I_0 of the section of the bar, and by the square of the number of bends in the curve assumed by the bar, and divided by the square of the length L_0.

If for a bar of uniform section we vary the load P_0 or the length L_0 without changing the mode of application of the load, the quantity ($n^2 \pi^2 E$) becomes a constant and we have the formula:

$$P_0 = \frac{\text{constant} \times I}{L_0^2}, \qquad (17)$$

which is identical with our formula (15) found from the experiments on flexure. The constant may not be the same in both cases, since the curve produced by compression is a sinussoid situated in one plane, whereas that due to flexure is the combination of a cubic parabola in the plane of flexure with what may be assumed to be a sinussoid in another plane normal to the former, the resultant being a curve in space. Moreover, we must bear in mind that the load is applied axially in one case and transversally in the other. Consequently, the terms ($n^2 \pi^2$) may have to be modified by a co-efficient (φ) whose nature we will endeavor to determine.

At this stage, when only too ready to launch into purely mathematical analysis based upon the unexpectedly successful results of a relatively small number of experiments, the writer was halted by the following consideration: Since the laws of the elastic equilibrium of a beam subjected to flexure have such a striking similarity to the theoretical laws of Euler governing the equilibrium of a long rod loaded axially, it would be logical to ascertain experimentally at once the degree of similarity of the laws. Consequently another series of tests was undertaken in which more care was exercised than in the previous one. Each specimen (a strip of rectangular section) was held at one end and carried at the other a gradually increased load. When the strip buckled, the load was recorded and removed; then the length being augmented by one inch, a new load was applied until the strip buckled anew and so on. In all cases the load acted vertically while the specimen occupied successively the positions:

1. Horizontal.
2. Inclined at 30° with the horizon.
3. Inclined at 45° with the horizon.
4. Inclined at 60° with the horizon.
5. Vertical, the load acting axially.

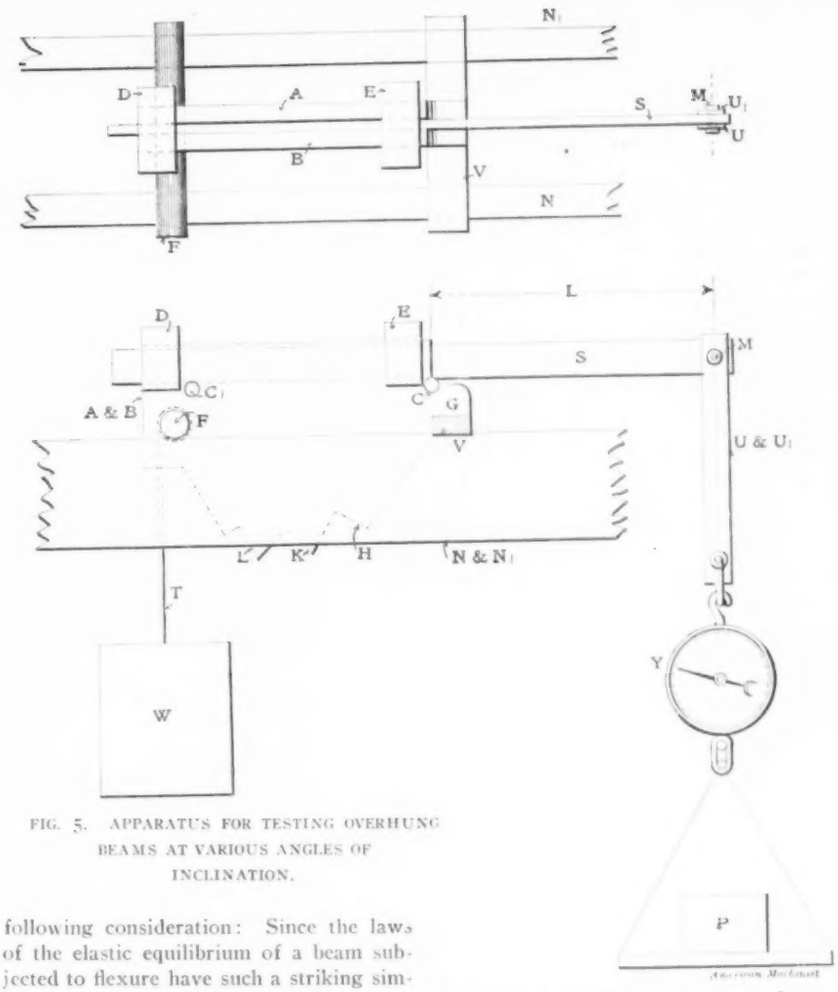


FIG. 5. APPARATUS FOR TESTING OVERHUNG BEAMS AT VARIOUS ANGLES OF INCLINATION.

Fig. 5 represents the apparatus employed for testing the specimen in four positions. The strip is placed between two wooden plates A and B, where it rests upon two pins C and C_1. The axis of pin C is in the plane formed by the two outward ends of the boards, so that the length L of the specimen may be measured from the center of the pin to the center M of suspension of the load. The boards are firmly pressed together by means of the clamps D and E. Consequently the beam may be truly considered as being *firmly held at one end and loaded at the other.* A large pin F passes through the two boards and extending on each side rests upon the supports N and N_1. The boards are cut at various points in such a manner that if one of these is brought upon a horizontal plane tangent to the lower side of the pin F the specimen is correspondingly held in one of the four positions described above. Thus, point G corresponds to the horizontal position, point H to the 30-degree position, point K to the 45-degree position, and point L to the 60-degree position.

The point selected rests upon a strong steel bar V. From the pin F is suspended a rod T holding a counterpoise W, which preserves the equilibrium of the system when the load is applied.

Two thin strips of wood U and U_1, firmly bound together at the lower end by a small bolt and nut, are secured at the top—one on each side of the specimen—by a small bolt passing through the center of suspension M, and are lightly kept together by the pressure of the nut. To the lower bolt is attached a spring scale carrying a board upon which is placed the load P, composed of blocks of iron. The total load supported by the beam is the sum of the weights of the strips, scale, board and blocks.

The mode of proceeding is very simple. A length L being selected for a given beam secured in the horizontal position, a load is gradually applied until buckling occurs. The load is recorded and removed. Then bar V is withdrawn and placed under point H just brought into the horizontal position by rotating the system about the rod F as an axis. The beam is thus inclined at an angle of 30 degrees with the horizon. A new load is tried, recorded and removed, and the system is again rotated with point K on the horizontal plane, thus inclining the beam at 45 degrees. And so on until a load is recorded respectively for each of the four positions. Then the system is again placed horizontally, the clamps D and E are loosened, the length L augmented by one inch, and the clamps being fastened anew another cycle of operations is gone through, and so on until the length becoming too great the bar is not rigid enough to insure the necessary exactness of the tests.

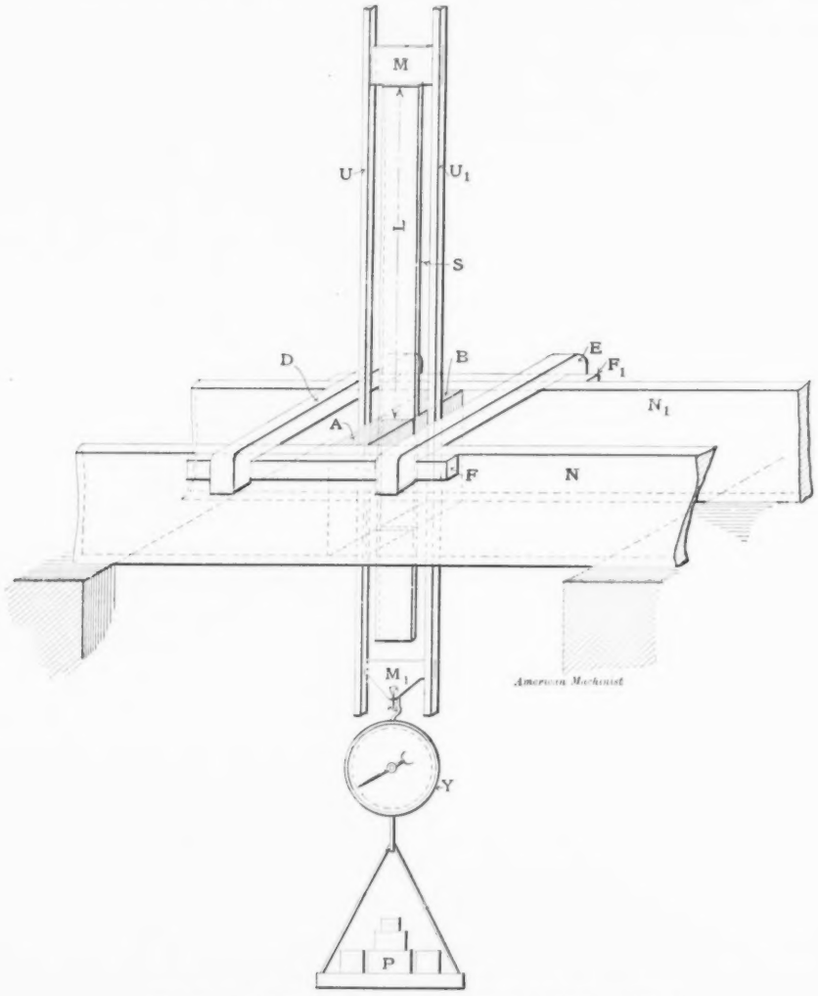


FIG. 6. APPARATUS FOR TESTING STRUTS LOADED AXIALLY.

The same apparatus cannot be used for experimenting in the fifth position, because in order that the test be exact it is necessary: First, that the bar be held firmly at the base; second, that the load be applied at the top, and that its direction coincide with the axis of the bar; third, that the bending or buckling of the bar be not hindered in any manner. This last condition is very important, as will be seen later, and cannot be complied with with the first apparatus, because the strips U and U_1, being placed in the direction of the probable deflection of the bar, would prevent this latter from bending freely.

Consequently, the apparatus represented in Fig. 6 was devised. To the supporting beams N and N_1 are fastened the wooden blocks A and B, respectively. The specimen S is placed between these latter and adjusted vertically, then the clamps D and E are tightened and the bar is thus firmly held. The clamps press against two steel bars $F F_1$, which distribute the pressure uniformly. The load is applied by means of a frame consisting of two cross plates $M M_1$ attached to the rods U and U_1. Plate M is knife-shaped at the base, but the edge is very dull. The scale Y attached to M sustains, as before, the board and weights P. The load consists of the sum of the weights of the frame, scale, board and weighing blocks. The length of the bar is measured from its top to the upper face of the blocks A and B.

The bar being firmly held, the load is gradually applied. Although the weighing blocks are placed upon the board with extreme care, the loading frame is not perfectly still; in fact, it oscillates like a pendulum and consequently communicates its motion to the top of the bar. Thus the bar vibrates gently and uniformly on each side of the axis, until about seven-eighths of the total load have been placed, at which time it becomes lazy; in other words, when during the period of one vibration the axis is vertical the bar seems to bend on one side in a shorter time than it takes to regain the vertical position. With a further increase of the load the bar finally fails to oscillate and remains slightly bent to one side. With less load it oscillates again, but with a further increase the bar falls forward with great velocity and would break were it not stopped in time. The load corresponding to which the bar failed to oscillate is recorded as being the maximum that the bar can hold in equilibrium. The weighing blocks are then removed, as well as the frame, and the clamps being loosened the bar is raised one inch and fastened anew. The cycle of operations is again gone through, and so on until the length of the bar becomes too great to permit an accurate test.

Some difficulty was found in placing the cross bar exactly on the center of gravity of the upper face of the beam. If M is not rightly placed the load does not act axially on the bar and consequently near the limit the beam bends toward one side only. The cross bar should be shifted a little until a position is attained, at which the beam bends indifferently to one side or the other. The carrying capacity is thus increased, and is maximum when the load acts axially.

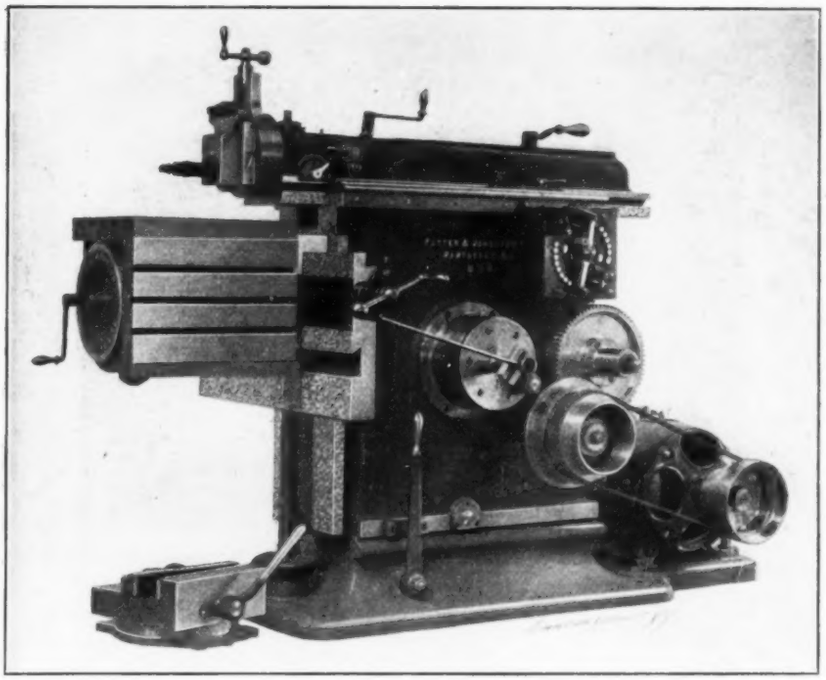
(To be continued.)

Electrically Driven Universal Shaping Machine.

The accompanying half-tone illustrates the latest pattern of shaping machine made by the Potter & Johnston Machine Company, of Pawtucket, R. I.

It will be seen to be electrically driven through three-step cone pulleys. The number of speeds given by these pulleys is, however, doubled through two sets of gearing of which one covers up the other in the engraving. The gears are carried in a shiftable yoke and are so arranged that but one set is in engagement at one time.

Among the noteworthy features of the machine is the adjustment of the ram head and the feed gear. A graduated dial enables the stroke to be adjusted to any required length, while the positioning of the ram may be done with the machine in motion. Both cross slide and tool head feed screws are fitted with micrometer dials. The down feed is automatic and has ten changes, which may be operated with the machine in motion. The changes are made by adjusting the index finger which has a dial plate behind it on the



UNIVERSAL SHAPING MACHINE.

ram, the position of this finger determining the rate of feed. Below and to the left of this is an arc slot with radial stop finger and knurled stop screw. The engagement of finger and stop throws out the feed and this may be made to take place at any desired point by suitably adjusting the stop screw.

The machine is fitted with a swivel table which may be adjusted through the arc of 90 degrees. The adjustment is by a worm and worm gear which do not show in the position photographed and the table is graduated. One side of the table is also made to tilt for added convenience in die and tool work. The table is raised and lowered by power, the feed screw being fitted with a ball step bearing.

The Bursting of Small Cast-Iron Flywheels.*

BY CHARLES H. BENJAMIN.

In November, 1898, the writer read a paper before this society on the subject of small flywheels, detailing the results of some experiments made in the laboratories of the Case School.

The discussion of the former paper and suggestions received from various engineers since its publication have led to further experiments on wheels of peculiar design. These experiments were all conducted under the immediate direction of the writer, and he was present at most of the destructive tests.

*A paper presented at the recent New York meeting of the American Society of Mechanical Engineers.

The wheels numbered 1 to 9, inclusive, were tested during the winter of 1899-1900 by senior students Messrs. Clyne and Mühlhaüser, while those numbered 10 to 16 were tested during the present year by Messrs. Austin, Mills and Stanford, instructors in the school. The wheels were all of cast iron, 24 inches in diameter, with proportions copied from existing wheels.

The general method of testing was similar to that used in the former experiments, but new apparatus was designed and built for greater convenience and safety.

Former tests had shown the insecurity of a wooden shield or cage for the bursting wheels. Fig. 1 shows the form of shield used in the later experiments. A cast-steel ring 36 inches in diameter inside, and having a rim section 4 inches by 6 inches was enclosed and supported by a wooden framework, the front and back being of oak plank, 3 inches thick. To absorb the energy of the flying fragments a sectional lining of Norway pine was used, as this could be easily repaired and renewed after each test. Fig. 2 shows the usual appearance after an explosion. During the sixteen experiments recorded but one wheel managed to escape from the shield, and this was due to the breaking of the bolts confining the side planking.

The wheels were keyed to the overhanging end of a steel shaft 1 7-16 inches in diameter, running in a long bronze bushing and coupled loosely to a Dow steam turbine. Fig. 3 shows clearly the rear of the shield and the connections.

As may be seen from the cut, the speed was measured by means of a countershaft and belted tachometer, the speed being reduced in the ratio of 1 to 10. Belts made of two thicknesses of adhesive electric tape together were found to be satisfactory at the speeds used, being free from slip.

The speed-counting mechanism was cal-

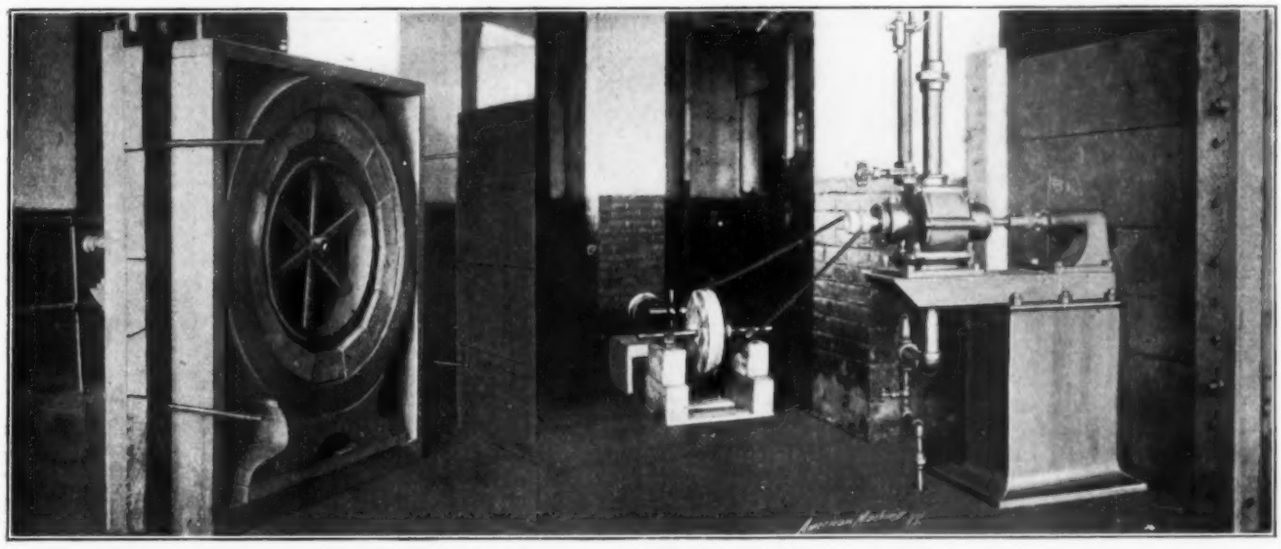


FIG. 1. TEST CASE FOR FLYWHEELS.

FIG. 3. DRIVING APPARATUS AND REAR OF TEST CASE.

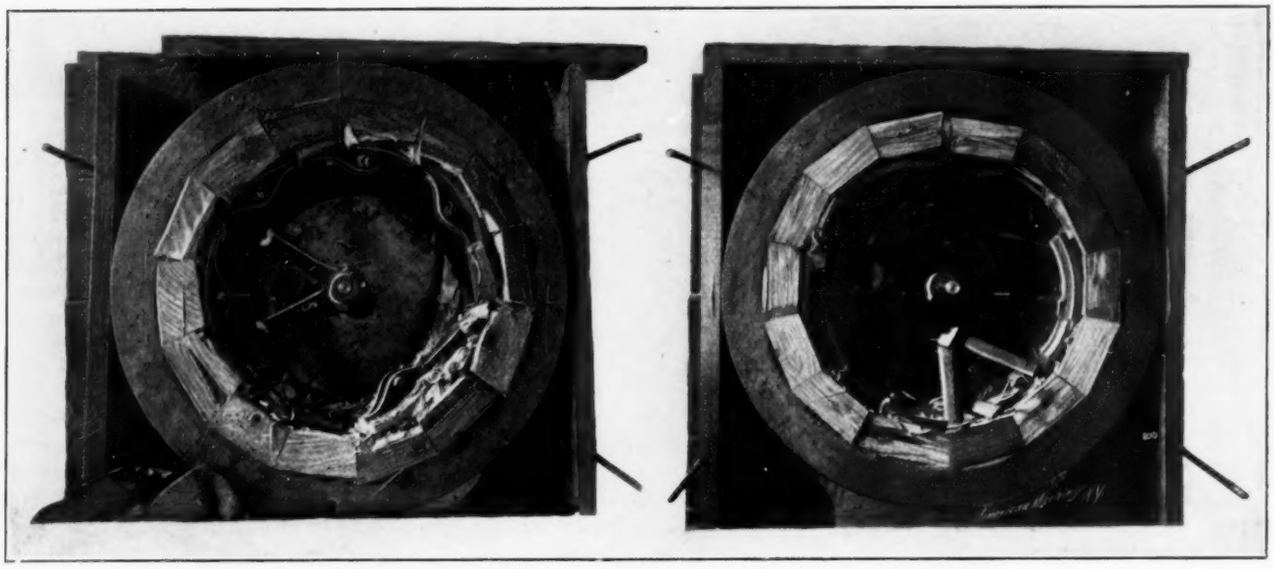


FIG. 2. USUAL APPEARANCE OF A WHEEL AFTER AN EXPLOSION.

FIG. 6. WHEEL SHOWN IN FIG. 5 AS IT APPEARED WHEN CASE WAS OPENED.

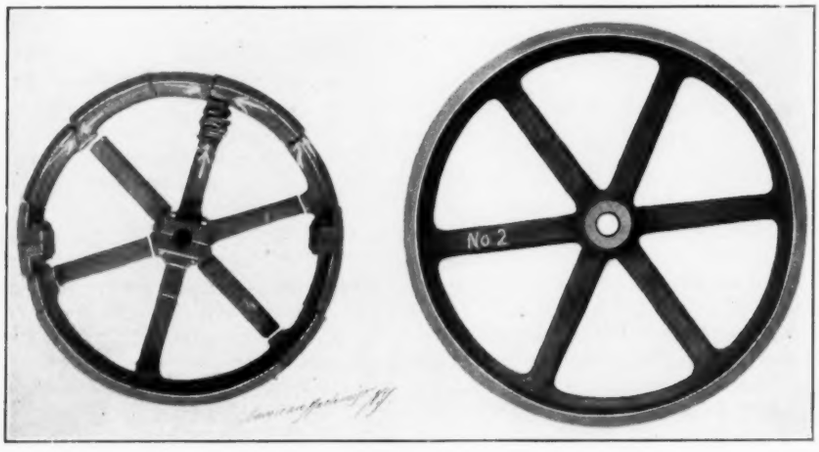


FIG. 5. WHEEL IN HALVES WITH JOINTS AT POINTS OF CONTRARY FLEXURE.

FIG. 4. SOLID RIM WHEELS USED AS A STANDARD OF COMPARISON.

No.	Rim.			Arms.			Weight of Wheel, Pounds.
	Diam., Inches.	Breadth, Inches.	Depth, Inches.	Area, Sq. In.	Number	Area, Sq. In.	
1.....	24	4.06	0.85	3.95	6	1.08	97.2
2.....	24	4.10	0.80	3.65	6	1.08	94.7
3.....	24	4.00	0.84	3.73	6	0.95	94.0
4.....	24	4.00	0.84	3.73	6	0.95	91.7
5.....	24	4.00	0.84	3.73	6	0.95	95.0
6.....	24	4.00	0.84	3.73	6	0.95	96.0
7.....	24	2.22	2.23	4.43	8	1.67	123.0
8.....	24	3.00	2.50	2.46	24	0.049	60.5
9.....	24	3.00	2.50	2.46	24	0.049	60.5
10.....	24	4.03	0.80	3.67	6	0.98	96.5
11.....	24	4.02	0.80	3.59	6	0.92	97.0
12.....	24	4.02	0.80	3.59	6	0.92	95.7
13.....	24	4.06	0.83	4.08	6	0.92	114.5
14.....	24	4.06	0.82	4.08	6	0.92	116.0
15.....	24	4.10	0.56	2.90	6	0.95	88.0
16.....	24	4.09	0.57	2.92	6	0.95	87.0

TABLE I.—DIMENSIONS.

No.	Flanges.			Bolts.		
	Thickness, Inches.	Net Breadth, Inches.	Net Area, Sq. Inches.	Number in Joint.	Diameter, Inch.	Total Tensile Strength.
3.....	1.0	2.4	2.4	4	.375	20,000
4.....	1.0	2.4	2.4	4	.375	20,000
5.....	1.0	2.4	2.4	4	.375	20,000
6.....	1.0	2.4	2.4	4	.375	20,000
10.....	1.0	2.4	2.4	4	.375	20,000
11.....	1.0	2.4	2.4	4	.375	20,000
12.....	1.0	2.4	2.4	4	.375	20,000
15.....	5/8	1.9	1.2	2	.500	18,000
16.....	5/8	1.9	1.2	2	.500	18,000

TABLE II.—FLANGES AND BOLTS.

ibrated many times, and showed an error of less than 1 per cent. All of the wheels tested were balanced carefully by winding lead wire around the arms close to the rim.

Wheels Nos. 1 and 2 were cast with solid rims and were modeled closely from a flywheel 10 feet in diameter on an Allis engine. These were tested to furnish a standard of comparison for the other wheels. Fig. 4 shows the shape and proportions of this class, and Table I gives the principal dimensions.

These two wheels failed at 3,700 and 3,850 revolutions per minute respectively, or at an average rim speed of 395 feet per second. This corresponds to a centrifugal tension of about 15,600 pounds per square inch. The fracture showed clean iron of a uniform quality.

The four wheels numbered from 3 to 6 each had two flanged joints in the rim, as shown in Fig. 5. These joints were of the same general proportions as those described in the previous paper, as may be seen by reference to Table II. At the suggestion of Mr. Jas. B. Stanwood, of this society, they were located at points one-fourth of the distance from one arm to the next, those being approximately the points of least bending moment.

No.	Bursting Speed.		Centrifugal Tension.	
	Revolutions per Minute.	Feet per Second.	Pounds per Square Inch.	Total on Rim.
1...	3,700	387	14,980	59,000
2...	3,850	403	16,240	59,000
3...	1,800	188.5	3,570	13,560
4...	1,850	193.6	3,750	14,000
5...	1,900	199	3,950	14,780
6...	1,850	193.6	3,750	14,000
7...	2,450	256.5	6,600	29,400
8...	4,050	424	17,970	44,000
9...	4,050	424	17,970	44,000
10...	1,570	164	2,700	9,920
11...	2,100	220	4,800	17,200
12...	2,200	230	5,300	19,000
13...	3,650	382	14,600	59,600
14...	3,850	403	16,300	66,500
15...	2,080	218	4,800	13,900
16...	2,175	228	5,200	15,200

TABLE III.—BURSTING SPEEDS.

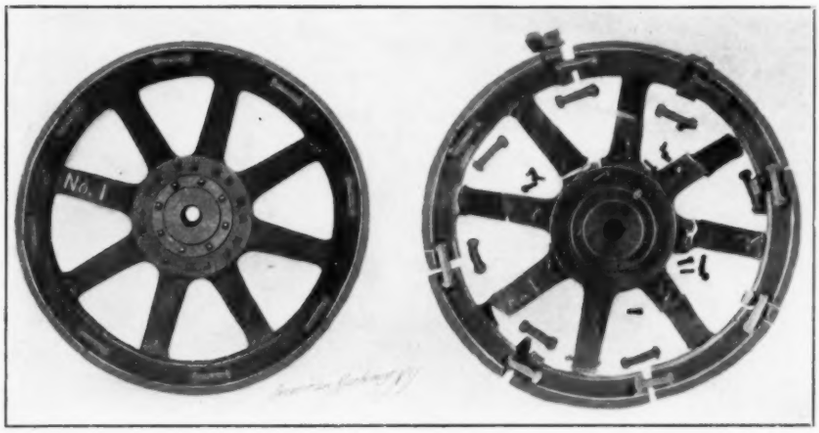


FIG. 7. FIG. 8.

ROLLING-MILL TYPE OF WHEEL BEFORE AND AFTER TESTING.

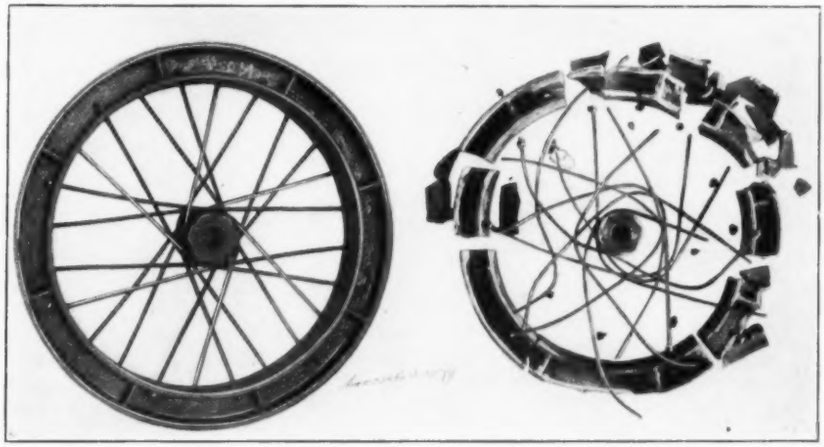


FIG. 9. FIG. 10.

WHEEL WITH SOLID CAST RIM AND WIRE SPOKES BEFORE AND AFTER TESTING.

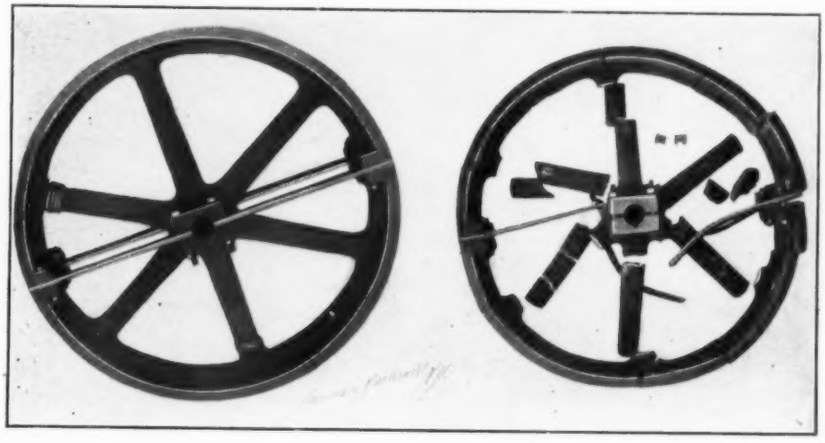


FIG. 11. FIG. 12.

WHEEL IN HALVES WITH REINFORCED JOINTS BEFORE AND AFTER TESTING.

As shown in Table III, these wheels burst at from 1,800 to 1,900 revolutions per minute, or an average rim speed of 194 feet per second. This corresponds to a centrifugal tension of about 3,750 pounds per square inch.

These wheels were then only one-quarter as strong as similiar wheels with solid rims and burst at one-half the speed. Comparing these with wheels of similar construction tested in 1898 (Nos. 13, 14 and 15 in the previous paper), we find that moving the joint from the center to the quarter point has made no appreciable difference in the strength.

This is, doubtless, due to the fact that the heavy mass of the flanges and bolts locates the bending moment at or near them. "Where MacGregor sits, there is the head of the table."

Fig. 5 shows the general manner of fracture of these wheels; strange to say, the joints usually remained intact—the bolts being slightly stretched—and the rim broke close to the joint, as shown in the cut.

The practically instantaneous character of the explosion is illustrated in Fig. 6 which shows the appearance of wheel No. 6 after rupture. With but one exception, each piece of the rim was embedded in the wood lining in its proper place and remained there, indicating a nearly simultaneous movement of the fragments. The lining was rotated in the steel ring through a considerable angle.

The combined tensile strength of the bolts in the flange joints was about 20,000 pounds, or less than one-third the strength of the solid rim, which is about the maximum ratio possible with this style of joint.

Wheel No. 7 was a complete working model of a flywheel for a blowing engine, and was copied from drawings furnished by a well-known firm of engine builders. The construction is clearly shown in Fig. 7, and the dimensions are given in Table I. The joints in the rim were carefully fitted and the links shrunk in. This wheel burst at 2,450 revolutions per minute, and a rim speed of 256 feet per second, which indicates a centrifugal tension of about 6,600 pounds per square inch, and shows that this wheel is nearly twice as strong as those just described. As may be seen by reference to Fig. 8, the wheel broke in every instance through the smallest section of the rim near the joint, the links remaining intact. It is interesting to note that every bolt in the hub was shaved off as clean as by a knife, each arm pulling out in this way.

Soon after the publication of the previous paper the writer had some correspondence with Prof. Archibald Sharp, of London, England, which resulted in the latter's sending to this country two model wheels to be tested, which are numbered 8 and 9 in the tables, and were constructed as shown in Fig. 9. The rims were solid, of an I section, and were made of a close grained cast iron having a high tensile strength.

Each wheel had 24 spokes of steel wire, 12 on each side of the central plane. A pair of spokes constituted a loop, fastened at each end to the rim with a thread and nut, and passing spirally around the hub in a groove cut for that purpose. By tightening up the nuts at the rim the wheel could be accurately centered, and sufficient friction caused at the hub to prevent slipping.

The two wheels failed at precisely the same speed, 4,050 revolutions per minute, or a rim speed of 424 feet per second. This would correspond to a centrifugal tension of nearly 18,000 pounds per square inch, and is probably the maximum speed attainable with a cast-iron rim. The appearance after rupture is shown in Fig. 10.

The rims usually broke through the holes

where the spokes were fastened, and the spokes themselves broke at one or both ends, where threaded.

The spokes had been adjusted to a uniform tension before the test by "tuning" them to the same pitch. This uniformity of tension, and the large number of spokes must have prevented any serious bending of the rims, so that the latter failed by direct tension.

The speed given is the highest attained in any of the experiments. One fact in connection with this last experiment deserves mention. It was found impossible at first to bring these wheels up to the desired speed; at about 3,000 revolutions per minute the speed would remain constant, and no increase of steam pressure would avail to change it. Becoming convinced that this was due to air resistance on the spokes and cross flanges of the rim the writer had the wheels inclosed by disks of Russia iron, wired together and revolving with the wheels. No further difficulty was experienced, and the bursting speed was attained within two minutes of the time of opening the throttle.

Similar devices had to be used with wheels numbered 13 to 16, inclusive.

Wheels numbered 10, 11 and 12 had the usual flanged joints located midway between the arms and fastened with four ⅝-inch bolts. The joints in wheel No. 10 were unsupported, while those in wheels Nos. 11 and 12 were strengthened by steel tie rods running from hub to joints and bolted at each end, as shown in Fig. 11. The net tensile strength of each tie rod was about 5,000 pounds. The two rods connected to each joint had then a combined tensile strength about two-thirds that of one arm. Wheel No. 10 burst at 1,570 revolutions per minute, a rim speed of 164 feet per second, which is only about five-sixths of the speed usually attained by this class of wheel. The break was in the rim just beside the flange, and the low speed would indicate a poor quality of iron.

Wheels Nos. 11 and 12 broke at 2,100 and 2,200 revolutions per minute, respectively, or at an average rim speed of 225 feet per second. Comparing these with wheel No. 10, as the three wheels were of the same iron and identical in every respect save the tie rods, we find an increase of from 34 to 40 per cent. in the bursting speed due to the use of the tie rods. This corresponds to an increase of nearly 100 per cent. in the strength of the joint. If the tie rods had been more carefully designed and constructed, a greater speed could have been attained.

Fig. 12 shows the appearance of wheel No. 12 after rupture. The ties broke through the bolt holes at one or both ends, the bolts remaining intact with but one exception.

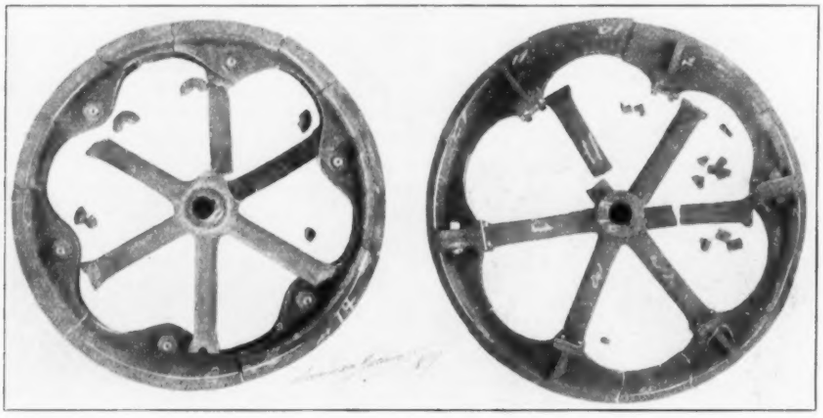


FIG. 13.
WHEEL WITH RIM IN ONE PIECE AND HAVING INTERNAL FLANGES AND SEPARATE SPIDER.

FIG. 14.
WHEEL WITH ARMS ATTACHED AT JOINTS OF RIM.

Wheels Nos. 13 and 14 were of peculiar construction, as may be seen from Fig. 13. The rim of each was cast in one piece, while the hub and arms formed a spider, also in one casting. The same were jointed to the internal flanges of the rim by ⅝-inch steel bolts, giving one degree of freedom. The object of this construction was twofold:

First—To relieve the bending moment at the junction of the arm and rim.

Second—By concentrating more weight near the arms to stretch these latter and thus relieve the bending moments in the rim midway between the arms.

These two wheels burst at 3,650 and 3,850 revolutions per minute, or an average rim speed of 392 feet per second. Comparing these figures with those given for wheels Nos. 1 and 2, we find that the speeds are practically the same. There is no apparent advantage in the special construction just described over the ordinary method of casting the spokes and hub with the rim.

Fig. 13 shows the appearance of wheel No. 13 after rupture. The arms all broke at the eye near the rim, the bolts not being injured. Only one web was fractured. Fig. 2 shows the wheel immediately after the explosion, the front of the shield and one cover plate being removed. The embedding of the rim fragments in the wood lining in their proper order is clearly shown, the same as in Fig. 6. The absence of any tearing or rending sound and the single sharp report, like a small cannon, also evidenced the practically instantaneous character of the explosion.

Wheel No. 14 was the one which escaped from the shield, as has already been noted. The wood lining was reduced to fine splinters, the cast-steel ring, weighing over 800 pounds, was rotated through an arc of 12 inches, a ¾-inch bolt was broken short off, and the 3-inch oak planking split and torn.

Wheels Nos. 15 and 16 were also of special construction, as seen in Fig. 14. The hub and arms were cast together as a spider and bolted to pads on the rim. The two joints in the rim came over arms, and the rim between the arms was reinforced by elliptic webs. The construction is a slight modification of that suggested by Mr. A. J. Frith, of this society, in a paper read in December, 1899. The *raison d'etre* of this form of wheel is explained by Mr. Frith in his paper. Briefly, this construction is intended to stretch the arms more and bend the rim less than the common form.

These two wheels burst at 2,080 and 2,175 revolutions per minute, respectively, or an average rim speed of 223 feet per second. Fig. 14 shows the manner of failure. The ends of the arms failed in several different ways: sometimes it was the screws that broke, sometimes the lugs on the arm, and sometimes the pad on the wheel. The rim usually broke at points midway between the arms. In wheel No. 16 the joints remained intact.

It will thus be seen that Nos. 15 and 16 were of practically the same strength as Nos. 11 and 12, but only about one-third as strong as wheels with solid rims.

The conclusions of the previous paper are confirmed by these further experiments. For wheels of moderate size correctly proportioned the solid rim is by far the safest form, and will require a speed of from 350 to 400 feet per second to produce rupture. The stress due to bending is so small as to be negligible.

Jointing the arms at the rim and bracing the rim by internal webs have no important effect on the strength.

Joints in the rims are the principal source of weakness, especially if located between the arms. Probably no joint can be made for a rim of solid cross-section which will be more than one-third as strong as the rim itself.

Hollow rims will permit of a much more efficient joint, as has been shown by Mr. John Fritz in his paper read at the meeting of this society in May, 1899.

The joints in Mr. Fritz's wheel are practically as strong as the rest of the rim. This construction is hardly possible in wide-faced band wheels such as are used on most shop engines. Joints similar to those shown in Fig. 14 are probably the best that can be devised for this type of

wheel. If joints are located midway between the arms they should be reinforced by tie rods leading to the hub.

The English wheels, Nos. 8 and 9, show clearly the advantage of numerous arms on any type of wheel. Even if the rims were jointed, such wheels would prove their superiority to those with the ordinary arms in maintaining their shape at high speed.

Theory and Design of Mechanical Brakes—II.

BY E. R. DOUGLASS.

Block Brake.—The block brake is ordinarily made with one block, as in Fig. 20, or with two blocks opposing each other

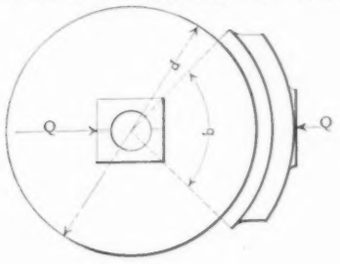


Fig. 20

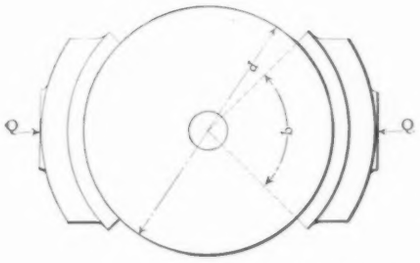


Fig. 21 *American Machinist*

SINGLE AND DOUBLE BLOCK BRAKES.

and pressed on to the drum with equal and opposite forces, as in Fig. 21. The former brings on the bearings a stress equal and opposite to that in the brake, a stress whose friction may require to be considered. The latter form takes all stress off the bearings.

In a block brake the pressure at any point between block and drum depends, at first, very much on the rigidity of the blocks and on adjustment, but, ultimately, the pressures at all points between block and drum will become such that all points on the block wear away at an equal rate in the direction of applied pressure. The retarding moment for one block, when this condition has been reached, may be found as follows:

Let d = diameter of brake drum, inches;
Q = force pressing block on to drum, pounds;
b = angle of drum embraced by one block, degrees;
f = coefficient of friction between block and drum.

Find

$$J = \frac{1}{1 - \frac{1}{3}\sin.^2\left(\frac{b}{2}\right)} \qquad (9)$$

Then the retarding moment for one block is:

$$M' = \tfrac{1}{2} J Q d f \qquad (10)$$

For more than one block, multiply by the number of blocks.

Values of J for any value of b may be taken directly from the curve of Fig. 22.

Axial Brake.—In this form of brake a rotating surface of revolution has a corresponding frictional surface pressed against it in a direction parallel to its axis of rotation. These surfaces will usually be cones. As a special case the cones may be opened out into plane disks. The frictional surface may then be either a complete ring or disk or a portion of one; or two surfaces may press against opposite sides of the same disk. These forms are shown in Figs. 23, 24 and 25.

The frictional parts are usually rigid. The effect of greater wear due to the increased velocities at greater radial distances is then to change slightly the forms of the surfaces and cause lesser pressures per square inch at points farther from the center. It is, however, possible to construct a brake of the disk form in which a uniform pressure per square inch is maintained over the whole frictional surface by employing hydraulic pressure to force a yielding diaphragm against the brake disk. The action of such a brake will be different from that of the final form of one in which a rigid disk is used. When first assembled the latter may or may not, depending on the perfection of its workmanship, also have a uniform pressure over the whole surface.

In a brake of the rigid conical form, let
d = larger diameter of frustum of cone,
d' = smaller diameter of frustum of cone,
l = length of frustum of cone,
X = axial force pressing the two cones together,
f = coefficient of friction.

Then the retarding moment of such a brake is:

$$M = Xf\frac{d+d'}{4}\frac{\sqrt{(d-d')^2+4l^2}}{d-d'} \qquad (11)$$

If the brake be a plain disk and the frictional surface be a complete ring or a sector of a ring, as shown, $l = o$ and

$$M = Xf\frac{d+d'}{4} \qquad (12)$$

If the brake be a plane disk but the pressure be uniform over the whole frictional surface, as explained,

$$M = \frac{1}{6} Xf\frac{d^3-d'^3}{d^2-d'^2} \qquad (13)$$

Application.—Having now the speed of rotation S, the total kinetic energy of moving parts $(W' + W'')$, the torque due to live load $\frac{Ld}{24}$, the number of seconds T' required for the mechanism to come to rest under its own friction, or the number of rotations N' made by the brake drum in so doing, and the retarding moment M of the brake, the number of seconds required for the mechanism to come to rest after the brake is applied will be:

$$T = \frac{1}{\frac{S}{2880\ W}(2M \pm Ld) + \frac{1}{T'}} \qquad (14)$$

The number of rotations made by the brake drum in so doing is:

$$N = \frac{1}{\frac{1}{24\ W'}(2M \pm Ld) + \frac{1}{N'}} \qquad (15)$$

If the live load assists in stopping the mechanism, the plus sign is to be used for Ld. If it opposes the brake action, take the minus sign.

In many cases the friction is so small that T' and N' are very large compared with T and N. Then we may use:

$$T'' = \frac{2880\ W}{S(2M \pm Ld)} \qquad (16)$$

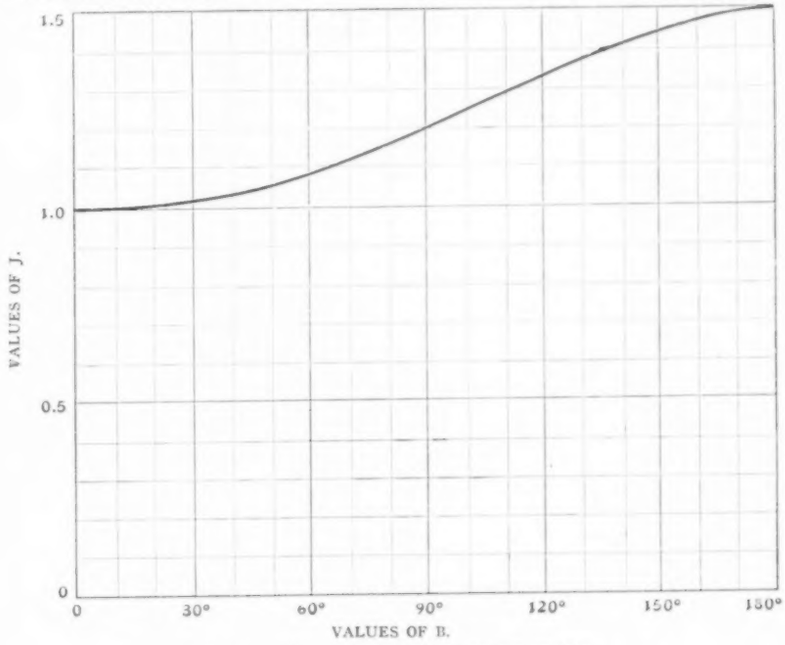


FIG. 22. THE ACTION OF THE BLOCK BRAKE.

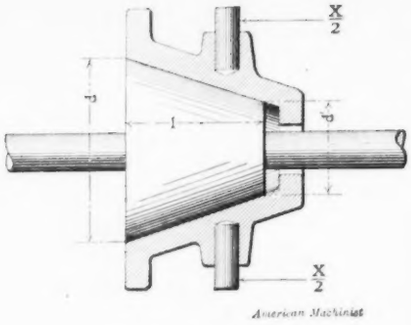


FIG. 23. CONE BRAKE.

$$N'' = \frac{24\ W}{2\ M + L\ d} \qquad (17)$$

If there be no live load, Ld drops out.

Design.—In designing a brake for a given duty, care must be taken not only that it shall be capable of exerting the proper torque, as determined by preceding formulas, but that its proportions are such as to distribute the wear over a sufficient area and to ensure that it will not become unduly hot under any conditions of its service. The latter consideration, especially, would seem to be frequently overlooked.

The duty of a brake may be expressed as the absorption of a certain number of foot-pounds of energy generally in a brief space of time and at frequently recurring intervals. As all this energy must be absorbed through the frictional contact surface, it is possible to determine a proper ratio of foot-pounds absorbed per square inch of contact surface. This varies not only with the material of the brake parts, but with different conditions under which the brake must operate. An insufficient contact surface would result in rapid wear and, possibly, in the generation of such intense local heat as to char and disintegrate the substance of band or block.

It is found that such brakes as are used on electric cranes where the work is severe and constant give good results when one square inch of wood or leather frictional surface is allowed for every 200 or 250 foot-pounds to be absorbed. Where the brake is less often called into service these figures may be much exceeded.

The brakes of railway cars, since they are all of metal, are used comparatively less frequently, and run under the most favorable conditions for keeping cool, are called on to absorb very much greater amounts of energy than the above. In ordinary service it may vary with speed and weight of car from 2,000 to as much as 20,000 foot-pounds per square inch of brake shoe. It is frequently sufficient to tear off and ignite the metal, causing showers of sparks. The wear is rapid and shoes must be frequently replaced.

The temperature which a brake will reach depends on the energy absorbed at each stoppage and the frequency with which it is caused to act. When the brake operates all the energy absorbed is changed into heat and passes into the material of the parts, whence it is gradually dissipated by radiation and through air currents. Since brakes are usually arranged to stop in a very short interval of time, all this energy is suddenly converted and raises the parts to a considerable temperature before it can be dissipated to any extent.

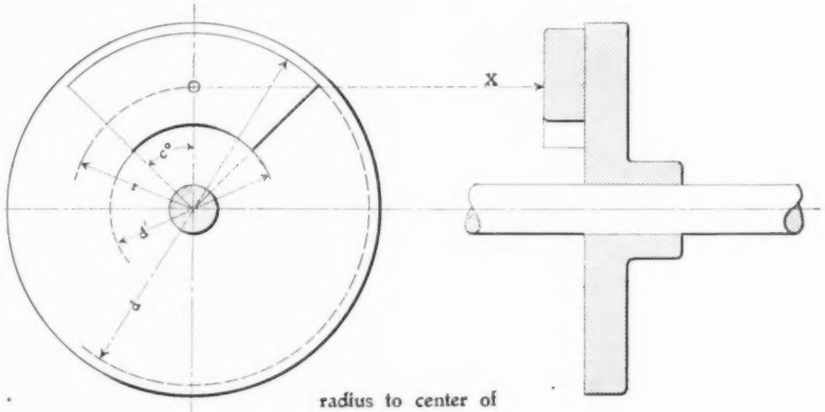
The number of foot-pounds of energy required to raise by 1 degree Fahr. the temperature of 1 pound of any material will be called h. It is proportional to the specific heat of the substance. For cast iron, $h = 100$; for wrought iron, $h = 87$; for brass, $h = 74$.

A greater or lesser amount of energy will cause a proportionately greater or lesser elevation in temperature. If the initial temperature be known, the final may readily be found. Good practice would keep the final temperature of a brake drum on which a wooden block or leather strap is used at less than 150 degrees Fahr. If the initial temperature be 100 degrees Fahr., this allows 50 degrees rise, corresponding to 5,000 foot-pounds for eacn pound of cast iron in the rim of the brake drum. It must be borne in mind that it is the metal of the rim only that receives the sudden accession of heat. The spokes or web and the hub are too remote to be influenced so suddenly.

Where metal shoes or straps are used, the permissible temperature will be considerably above that named in the preceding paragraph. In this case it is limited, not by fear of charring the block or strap, but of cracking the drum by unequal expansion. Proper allowance being made for expansion, and other circumstances permitting, there is no reason why temperatures of 400 or 500 degrees Fahr. should not be used.

If the brake is in frequent use, it will not have time to cool off between operations and the initial temperature, before each rise, will be considerably above that of the surrounding air. Thus, in a preceding paragraph it was assumed to be 100 degrees Fahr.

It is difficult to assign any rule for the amount of heat that will be carried away by radiation and by air currents in a given time. It will vary with the location of the apparatus, whether exposed or not, whether it be running, with the shape of the parts and character of the surfaces, and so forth. As an indication of its magnitude it may be stated to lie, generally, between 0.4 and 0.8 of a foot-pound of



radius to center of area of shoe —

$$r = \frac{60}{\pi} \frac{\sin c^\circ}{c^\circ} \frac{d^2 - d'^2}{d^2 - d'^2}$$

Fig. 24

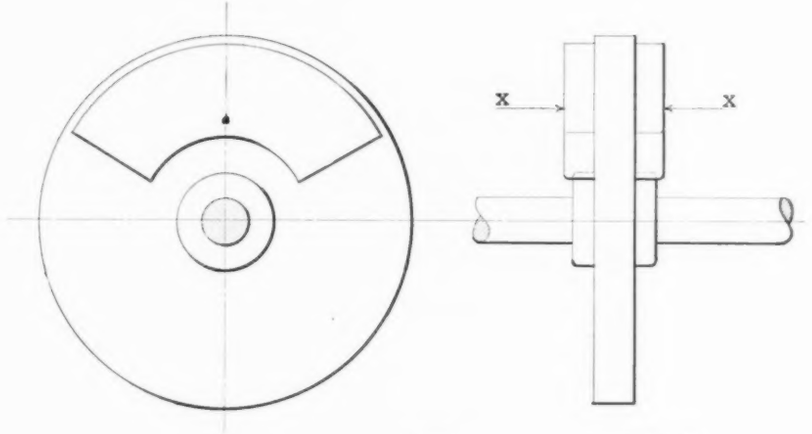


Fig. 25

DISK BRAKES.

energy per minute for each square inch of surface and each degree Fahr. which that surface is above the temperature of the surrounding air. This factor will be called p.

Suppose a brake to be called into action regularly every L minutes, absorbing Q foot-pounds of energy at each operation.

Let

W = weight of metal in brake drum rim, pounds;

A = radiating surface of rim, square inches;

h = foot-pounds per pound of metal per degree rise, as in preceding paragraph;

p = radiating factor, as just explained;

t_1 = maximum temperature of brake drum attained just as machine comes to a stop;

t_2 = minimum temperature, just before brake is applied, reached after L minutes of cooling.

Find G such that:

$$\text{com. log. } G = 0.434 \frac{L\,p\,A}{h\,W} \qquad (18)$$

Then

$$t_1 = \frac{Q}{h\,W\left(1 - \frac{1}{G}\right)} \qquad (19)$$

$$t_2 = t_1 - \frac{Q}{h\,W} \qquad (20)$$

By these formulas the heating of a brake under any given conditions of service may be at least approximately determined.

If the radiating factor p be known from previous experience, this determination becomes fairly close.

A Decimal System for Numbering Working Drawings.

The system described below is similar to the Dewey Decimal System used for numbering books in libraries, but is not an extension of that system and the numbers should not be confused with the Dewey numbers.

In applying this system the product of a works should be divided into ten primary divisions and each of these divisions into ten classes and these classes into ten sub classes. This gives 999 different sub classes, or, as the zero is needed for a special use, 810 sub-classes, which will cover the product of most works.

The primary divisions are designated by digits in the "hundreds" place the classes by those in the "tens" place and the sub-classes by those in the "units" place.

Thus the number 836 indicates an article in the 6th sub-class of the 3d class of the 8th division.

The machine parts, supposing the product to be a machine, are divided in the same way and represented by decimals. Thus, if 836 is a certain type of engine, .4 may indicate the general frame, .45 the platform and .456 platform brackets. The drawing for platform brackets of this engine would be marked 836.456—3, the figure after the dash being the distinctive mark of this drawing, it being the third platform bracket made for this type of engine. The tracing would be filed in drawer 836.4, and should this become crowded another drawer may be added marked 836.45 and the tracing would be in its proper place in there.

This brings all tracings of the same kind of machine together, but it is often desirable to make a different arrangement. For instance, the same steam cylinder may be used with engines intended for several different services and of different types, and it may be preferred to keep those of a common length of stroke together. To accomplish this the zero (0) is reserved for use wherever it is desired not to restrict the use of the drawing to one particular unit in a class. Suppose the number 836.3 is the characteristic number for the steam cylinder of the above engine and that the 6 in the "units" place indicates the type of the engine, but that this cylinder may be used with several types, its number, then, becomes 830.3; the tracing is filed in drawer 830.3, a drawer of standard steam cylinders of this particular stroke.

Below is given an illustration of the application of this system to drawings for the manufacture of pumps and pumping machinery, this work having probably as great a variety as any that could be found.

The letter P is prefixed to prevent confusing pump drawing numbers with order-numbers or those of other classes of machinery.

PUMPS AND PUMPING MACHINERY.

Primary or "Hundreds" Division.

P000.—Lists and other matter relating to pumps in general.

P100.—Single Direct Acting Pumps. (Steam, water, gas or otherwise driven.)

P200.—Duplex Direct Acting Pumps. (Steam, water, gas or otherwise driven.)

P300.—Flywheel Pumps (having reciprocating water and power ends).

P400.—Geared and Electric Pumps. (All reciprocating pumps which receive their power from a rotary motion.)

P500.—Rotary Pumps.

P600.—Centrifugal Pumps (turbine pumps, propeller pumps).

P700.—Hand Pumps.

P800.—*Standard Pump Parts which are kept in stock.

P900.—Auxiliary Apparatus (separators, condensers, accumulators, drain tanks, boilers, etc.).

Each of these divisions is divided into such classes as its needs dictate. Taking duplex pumps as an example, we have in the "Tens" class:

P200.—Drawings of Duplex Pumps without dimensions. (Shaded drawings for catalog use, etc.)

P210.—Duplex Pumps of 3-inch stroke and under.

P220.—Duplex Pumps from 3-inch stroke to and including 6-inch stroke.

P230.—Duplex Pumps from 6-inch stroke to and including 10-inch stroke.

P240.—Duplex Pumps from 10-inch stroke to and including 15-inch stroke

P250.—Duplex Pumps from 15-inch stroke to and including 18-inch stroke.

P260.—Duplex Pumps from 18-inch stroke to and including 24-inch stroke.

P270.—Duplex Pumps from 24-inch stroke to and including 36-inch stroke.

P280.—Duplex Pumps from 36-inch stroke to and including 48-inch stroke.

P290.—Duplex Pumps over 48-inch stroke.

Each of these "tens" classes is divided into "units" sub-classes, according to the type of water end, and as the same types run through the different strokes they may be divided so that a "unit" digit will have the same meaning throughout the series. This has the advantage that anyone who handles the drawings sufficiently soon learns to recognize the type of pump from the digit in the "units" position. This is convenient, but is not at all necessary to the system and should not be done if it complicates instead of simplifying.

The division into sub-classes as to type of water end is:

"UNITS" SUB-CLASS.

Type of Water End.

P201.—Piston Pattern.

P202.—Plunger and Ring Pattern.

P203.—Outside Center Packed Plunger Pattern.

P204.—Outside Packed Double Plunger Pattern.

P205.—Admiralty Pumps.

P206.—Sinking Pumps.

P207.—Bucket Pumps.

P208.—Single Acting Plunger Pumps.

The number P232 indicates a duplex pump of more than 10-inch stroke and not over 15-inch stroke and that it is of the plunger or ring type.

The first fractional classification is of the main portions of the pump or engine.

"TENTHS" CLASS.

P200.0.—General Elevations and Foundation Plans.

P200.1.—Steam Cylinders.

P200.2.—Water End.

P200.3.—Cradle, Frame and Platform.

P200.4.—Steam Pipes, Reheaters and Exhaust Pipes.

P200.5.—Suction and Delivery Pipes.

P200.6.—Attached Air Pump.

P200.7.—Balancing Cylinders.

P200.8.—High Duty Attachment.

In the second fractional class each size and general type is divided as required by its individual case without regard to others of the same type. For instance, P241.2 indicates 15-inch stroke duplex piston pump water cylinders. They are divided as follows:

P241.21.—Standard Pumps for pressures under 50 pounds.

*It may seem illogical to place stock parts as a primary division, but these are treated as a finished product in the shop and I believe they could be so treated in the drafting room with considerable saving of labor.

P241.22.—Standard Pumps for pressures over 50 pounds.
P241.23.—Independent Condensers.
P241.24.—Special Air Pumps.
P241.25.—Special Circulating Pumps.
P241.26.—Vertical Ballast Pumps, etc., into not more than nine classes.

The digits in the "thousandths" place indicate the separate pieces into which the parts in the "tenths" place may be divided. Thus, the characteristic number for the cone of an independent condenser in the last example is P241.231, for the special stuffing box P241.232, for the piston if special P241.233; but if a standard water piston is used its characteristic number is P201.203 and it is found in drawer 201.203 standard water pistons.

Every tracing must have a distinguishing number after its characteristic number. This may be found from lists similar to the "shelf lists" kept in libraries from the card record which would show the next previous number given with that characteristic number.

The advantages of this system are that the tracings are filed in the drawers both in numerical order and according to their subject matter and may be found without looking up record cards. It insures that the tracings are kept according to a fixed, prearranged, well-thought-out system, instead of one which grows up of its own accord and in which everyone marks his tracings with the drawer number which "seemeth right in his own eyes."

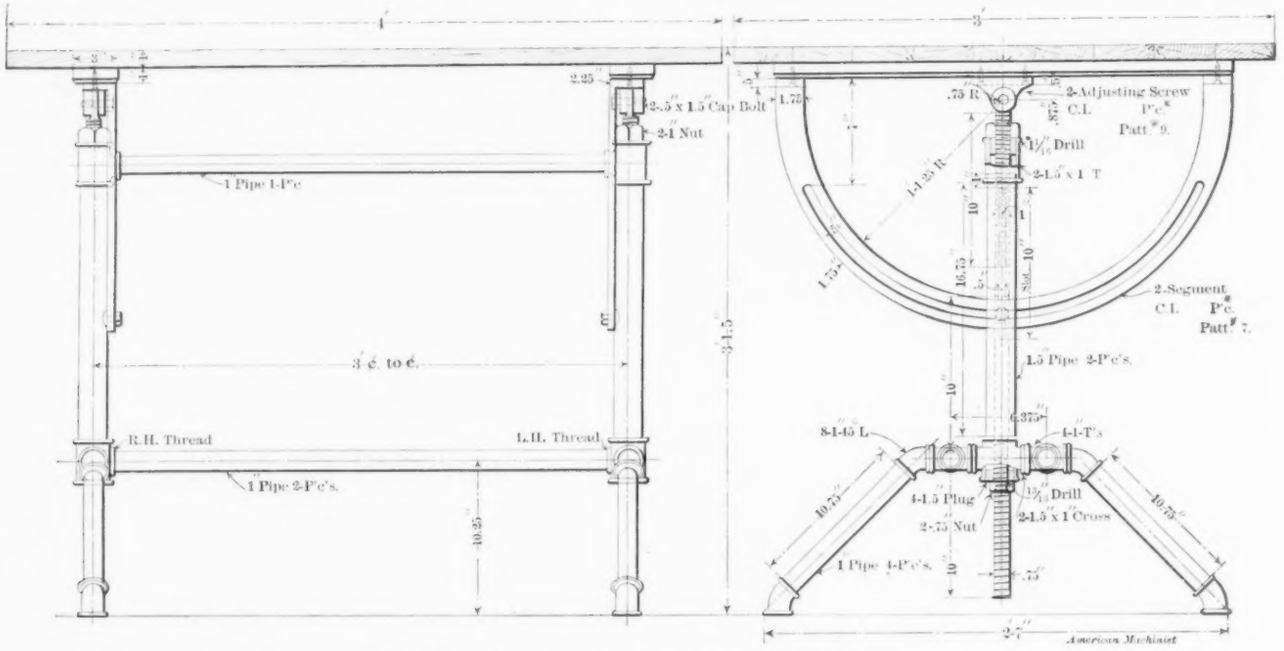
If the system is worked out in detail to start with, and the tracings are given the complete number even to the last fraction, they will not need to have the number changed no matter how often the number of drawers is increased.

When several shops are associated under one management, drawings numbered by this system (with a shop letter instead of the dash following the characteristic number) may be sent from one shop to another and filed in the proper places without creating trouble or confusion.

HENRY L. HUTSON.

A Draftsman's Table Made Out of Iron Pipe and Fittings.

In the drafting room of the new works of the Franklin (Pa.) Air Compressor Company they have equipped with drafting tables which are at least as neat and efficient as any we have ever seen and at the same time they are made mostly out of stock materials. The stand was designed by Mr. Webb, the superintendent, when he was acting as chief draftsman. The engraving made from the working drawing shows the construction so clearly as to leave little to say in the way of explanation. The segments and the adjusting screw yokes are the only parts requiring patterns to be made for them and every other part is a commercial article except the adjusting screws which are threaded on a bolt-cutter. It is to be noticed that the segments are large enough to give very firm support to the table and the draftsman can lean as much of his weight upon it as he chooses without danger of anything slipping. No finish is put upon the segments; they are used as they come from the sand. The stands are painted white, present a very neat appearance and in use have proven as good as they look. John Grant has adopted the same table in the drafting room of his new works, but has replaced the upper nuts on the adjusting screws with sprocket wheels, which are connected by a chain, so that the two screws are adjusted together. This, of course, adds to the convenience of the arrangement and probably causes the hight of the table to be changed a good many times when it otherwise would not be.



A DRAWING TABLE MADE MOSTLY OF PIPE AND FITTINGS.

A Lathe Shown at the Pan-American.

At Buffalo there was plenty of opportunity for seeing what facilities are offered at this, the beginning of the twentieth century, in the way of facilities for doing work and there was also in the Midway one place in which work could be seen going on with tools and facilities that were devised very many years ago and have probably not undergone any change since. We present two views of Tahar Ben Mh of Tunis, Africa, turning woodwork in his booth in that part of the Midway known as The Street of Cairo. Tahar's lathe consisted of a couple of scantlings for a bed, two blocks of wood for head- and footstock, two bent pieces of iron driven into these blocks for centers, and a square bar of iron resting upon the blocks for a rest—no spindle, no tail-stock screw, no cone pulley, no pulley at all, no belt, no anything in fact that the turner, as we know him, considers necessary, and yet Tahar turned out quite creditable work; not very rapidly, of course, judged by our American latter-day standards, but still he made better progress than might be thought possible.

The centers of Tahar's lathe were only about 10 inches from the floor and he always sat down when at work, which was fortunate for him, because if he had stood up it would have been necessary for him to stand upon one foot, for he guided his chisels with the toes of his right foot and the fingers of his left hand, the other hand being occupied in working the bow

that rotated the work. This bow was simply a stick with a cord attached to each end of it, and the cord was enough longer than the stick so that it could pass once around the work and still not be tight. The reciprocating motion given to the stick by Tahar's right hand gave a rotary motion to the work, first one way and then the other, and when it was turning backwards Tahar usually shifted his chisel a little and perhaps changed the position

of his heel a little upon the floor so as to be ready for the cut when the work turned toward him again.

He made me a top under the stimulus of a suitable bribe, remarking as each stage of the operation was completed, "very good," which appeared to be the extent of his English vocabulary. His chisels were much the same as our American wood turners use; indeed looked as though they might have been made in America, and it was extremely entertaining to see him place his great toe within the hollow of a gouge and roll it along the rest by the combined action of his foot and his hand. Some work he placed directly upon the centers at both ends, but he had a lot of chucks also which were made of iron, had a center in one end and were bored out at the other to receive the work, the projecting end of which was placed upon the other center. In such a case the bow string passed around the chuck instead of the work. He made the stem of my top that way, and when he had it turned to the right size wet it with his tongue and twisted it firmly into a rough block of wood which had previously had a hole bored through it; after which he proceeded to turn the block into shape, made it quite smooth, and, taking a very American-looking lead pencil from some mysterious depth of his mysterious clothing, held it upon the rotating work, and thus drew lines upon it which gave it a certain finished appearance. Then he turned the point of the stem as small as he dared, broke it off, whittled it to a sharp point, and the top was done.

The photographs were taken by F. Wesley Parker, who represented the Morse Twist Drill & Machine Company at Buffalo. One of them shows Tahar making a top and the other a chair post, which he has gotten just about to one of the "very good" stages of its progress toward a job of which no turner would need feel very much ashamed but which, unless Tahar works at very low wages, will cost more than an entire chair would cost made in an American chair factory. F. J. M.

A LATHE EXHIBITED AT THE PAN-AMERICAN.

Machinery and Wages.

"At one time in the United States a roller in a rail mill, rolling iron or steel rails, received about 15 cents per ton, turning out from 75 to 100 tons per turn. To-day, on some of the modern steel rail mills less than 1 cent per ton is paid for doing the same work, and yet by the end of the year the roller in the rail mill to-day can make as much money as he did when he received the above higher prices under the old method of working, and that, too, with less physical labor.

"At one time 45 cents per ton were paid for heating iron for making iron rails. To-day, through the use of the improved methods, very little more than a half a cent per ton is paid for doing the same work—making steel rails—and yet the wages received per month or per year are as good, and better, to-day than they were at that earlier time.

"One of the most remarkable results in this direction recorded in the history of iron and steel is the price paid for rolling wire rods. At one time, about twenty years ago, a man having charge of a rod mill received $2.12 per ton of rods made, out of which he paid no help whatever. At that time 12 or 15 tons were considered a good day's work. To-day it has become almost a common practice to make 200 tons of wire rods in a single turn; and upon the basis on which rod rollers are paid to-day, they would not receive much more than 12 cents per ton. This, however, enables the roller of to-day to make as much money as the roller did twenty years ago, producing only 12 tons per turn.

"About twenty years ago 18 cents per ton were paid for heating billets to make wire rods; to-day 5 cents per ton are com-

monly paid, and the daily wage is higher than it was when 80 cents per ton were paid.

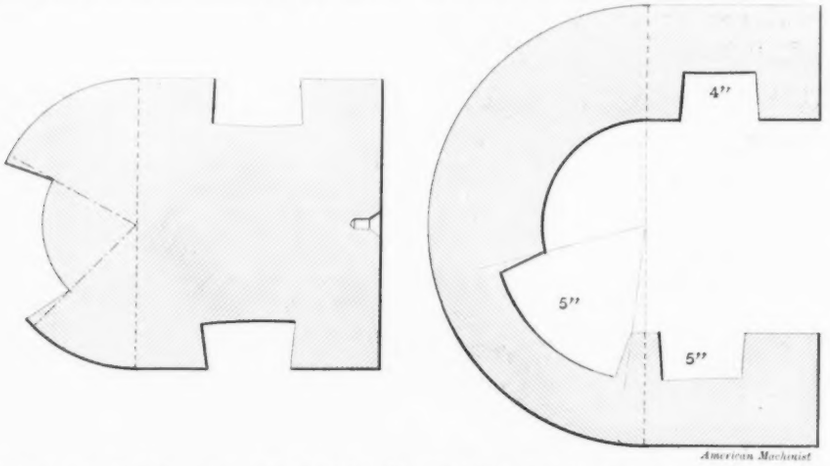
"If some of the rollers now employed at the Homestead works of the Carnegie Steel Company rolling structural steel were paid the same wages per ton that were paid twenty years ago they would be receiving from $200 to $250 per turn or a single day's work. On the same basis, if rod rollers to-day were to receive the same per ton that they received twenty years ago, viz., $2.12, then for a turn's work of 200 tons they would receive $424 per day, or single turn. Yet this was the bone of contention that led to the great Homestead strike which outraged the feelings of all organized labor societies in the world."—William Garrett, in "Cassier's Magazine."

Letters from Practical Men

Cutting Square Threaded Screws.

Editor American Machinist:

The article at page 1160 on "Cutting Square Threaded Screws" points out a fact known to us for fifteen years or more,



Screw, 3 inches diameter, 5-inch pitch. Nut, 2¼ inches inside bore, 4 and 5-inch pitch.

LONGITUDINAL AND CROSS-SECTIONS OF STEEP PITCH SQUARE THREADS CUT WITH INCLINED SQUARE TOOL.

but we must venture to say that Mr. De Leeuw seems to be mistaken when he expects that the threads will come out in all cases one-sided, as in his Fig. 5.

When the tool with the edges *M* and *I*, Fig. 1 stands—as designed—with its center at the same hight as the center of the screw the sides of the thread will turn out quite symmetrical.

Mr. De Leeuw's illustration will prove this, for, as the width of the cutter is greater than the distance of the interior spiral curve *A C* from its fellow-curve, it follows that the tool must cut at the bottom wider than the distance between the two curves, as shown in the drawing.

The accompanying prints on white paper are from specimen nut and screw made on purpose to prove what we state. The specimens were cut in half to permit printing directly on paper.

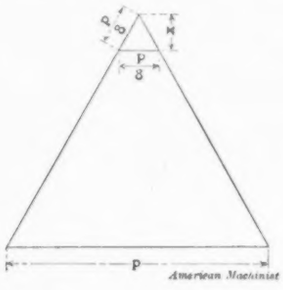
WERKZEUGMASCHINENFABRIK UNION.
OSCAR UFERT. EMIL DIEHL.
Chemnitz, Germany.

[Our engravings are from blueprints which accompany the "rubbings" made from the screw and nut. The blueprints faithfully reproduce the "rubbings," but are used because they are better adapted to the needs of the engraver. The two threads which appear in the nut are not explained, but we judge the nut to have been so short as to have contained but a part of a turn of the thread and that a cut of 4 inches pitch was made on one side and one of 5 inches on the other.—Ed.]

Sizing Taps with United States Standard Section Threads.

Editor American Machinist:

The following method of making United States standard taps may be new to some of your readers. It is especially advantageous when there is an odd thread to be cut and nothing to gage it by. Briefly it consists in turning the tap enough larger, so that when the thread is perfectly sharp it will be the right depth, and afterwards taking a cut over the top to reduce it to the proper diameter and make the flat surface produced just one-eighth the pitch,



as is required. By using a correct thread tool, such as the Pratt & Whitney Company makes, one can be sure of the diameter of the thread.

To obtain the amount to be added to the diameter, we have the formula:

$$2x = .2165\,p,$$

obtained very simply, as shown by the sketch, as follows:

$$x^2 = \left(\frac{1}{8}\,p\right)^2 - \left(\frac{1}{16}\,p\right)^2$$

$$= \frac{1}{64}\,p^2 - \frac{1}{256}\,p^2$$

or $$2x = .2165\,p.$$

The following table gives the value of $2x$ for different pitches from ¼ to 1-18:

No. of Threads per inch.	Amount to add to diameter of Tap.
4	.0541 inch
5	.0433 "
6	.0360 "
7	.0309 "
8	.0270 "
9	.0240 "
10	.0216 "
11	.0196 "
12	.0180 "
13	.0166 "
14	.0154 "
15	.0144 "
16	.0135 "
17	.0127 "
18	.0120 "

THOS. A. BRAGG.

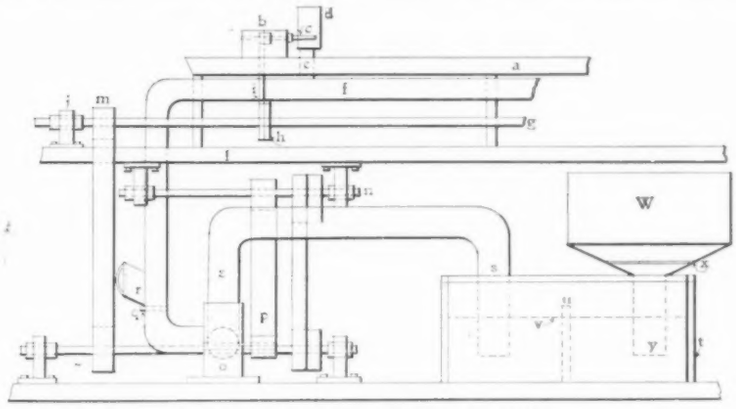
A Polishing Arrangement for Gold and Silver, and the Collecting of the Dust.

Editor American Machinist:

Having been connected with the manufacturing jewelry business for a number of years, a great many devices therein employed have come to my notice. It would take a long time to describe the different systems used for polishing. This which I am going to describe is the best arrangement I have ever seen.

When jewelry is finished it is polished with rottenstone and rouge. This rouge is of a deep red and very penetrating, and the least bit escaping in the polishing room adheres to the walls and ceilings, until they in a short time are all discolored. There is more or less gold or silver in this dust, and it is quite essential that it should all be saved and sent to the refinery. The bench has twenty polishing lathes, and as they are always two feet apart the bench is about 24 feet long. The bench is of pine with iron legs, the top having a strip around the sides about 4 inches high, the bottom and sides lined with zinc. The lathe *b* is a box lathe having a shaft with a tight and loose pulley. The spindle is drilled and tapped for the brush arbor *c*, this being taper and threaded the entire length, to accommodate the brushes. These vary in size, their centers being lead. Every time the wheel is screwed on the hole grows larger. The hood *d* is of tin and covers the wheel, except a space in front where the operator works. At the joint where the pipe *e* connects with the hood is a wire netting about ¼ inch mesh, to prevent any work

from being drawn down the pipe. The pipe *c* on hood connects with the pipe *f* under the bench. This pipe varies in size according to the number of lathes. It is placed at the back of the bench, as the driving shaft runs along the center. On this driving shaft are pulleys *h*. The pipe *f* turns down through the floor, so that practically there is nothing in the polishing



COLLECTING THE DUST IN GOLD POLISHING.

room to throw dust barring what little escapes from the wheel on the lathe. The blower *o* is fastened to the floor of the basement, and is driven by the belt *p*. The pipe *f* connects on the blower at the side. In this pipe there is another strainer *q* and above this strainer an opening *r* with a tight cover. The pipe *s* connects with the front of the blower and enters the zinc-lined, water-tight tank *t*. In the center of this tank is a partition *u* about three-quarters of the hight. The tank is kept filled with water to line *v*. The pipe *s* from the blower enters the tank through the top, the end extending down into the water. The cylinder *w* of galvanized iron stands over the tank on the other side of the partition and a pipe extends from it. Another strainer is placed at *x*. The body of the cylinder is filled with wet excelsior. When the bench is in use the operator sits in front of his lathe, and as the work is being done the dust is drawn into the hood, down the pipe *e*, into the pipe *f*, through the blower and into the tank under the water. A certain amount of the dust here loses its velocity and falls to the bottom of tank; whatever remains rises above the water to the top of tank and passes over the partition and into the water on the other side. A portion of this remaining dust will rise, there being no other opening but that in pipe *y*. It enters the pipe attached to the cylinder, and there rises, encountering the dampened excelsior to which it adheres. By the time the dust passes into this excelsior there is very little force, and it rarely reaches the bottom of the cover of the cylinder. It will be noticed that each succeeding pipe is larger than the preceding. The air at the hood must have a certain force to do its work, and, entering a larger pipe from a smaller, will decrease its force. For a bench of ten lathe heads this tank needs cleaning about once a month, which is done by drawing the water into barrels, after which the bottom and sides of the tank are scraped and the sediment also placed in barrels. The top of cylinder is removed and the excelsior also is placed in barrels, and the cylinder is then washed by use of a hose. This water is then taken from the tank and placed with the other, and the whole is sent to the refinery. The amount of gold taken from this dust is sometimes amazing.

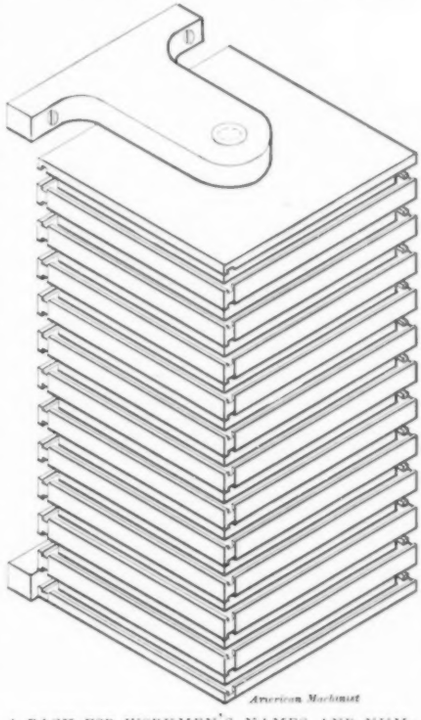
VER I. NIER.

Keeping Names and Numbers of Men.

Editor American Machinist:

I send you a sketch of an idea for keeping track of the names and numbers of the men inthe shop, that has been used for several years and proven to be a good thing.

When a foreman has over 50 or 75 men in charge, it is hard to keep the number of each one in his head, and the new system of time cards in use in some shops makes it imperative that he should always have them before him. I refer to the method by which the foreman or his assistants make out the cards for the whole shop, the men only drawing a pencil through the six o'clock mark. Personally, I dislike the system very much, but I know it to be a great convenience for the office, as it keeps track of the work the men do and of the time they spend in doing it the best of any method I know of, but it is hard on the foreman.



A RACK FOR WORKMEN'S NAMES AND NUMBERS.

The case in use and shown in the sketch is 6x6x12 inches and will hold 96 names. We happened to have a punch and die that was just right for the name slips, so they are all the same. The case is just a hollow pine cube fitted with twelve pockets on each side that will hold two slips each, and it is hung on brackets so that it can be revolved.

When a new man comes in put his name and number on a slip and shove it into the rack with the date of his engagement, and when he leaves put on the back of the slip the date and the reason of his leaving, together with a few private notes of your own that will call him to mind if you have occasion to look up his record.

I think that every convenience of this kind that a foreman can get hold of is one thorn taken out of that rose-filled mattress on which every foreman is supposed to repose. I have worked at the bench and off of it, and I am sure I got more solid comfort out of life when I was at the bench, but the trouble was I didn't realize it. I thought the boss had an easy berth, and until I got into it I didn't know what a lot of thorns it contained.

A. P. PRESS.

Kinks in Steam Heating.

Editor American Machinist:

At this season of the year the superintendent and the foreman of the machine shop think with a shudder of their steam-heating systems; and their worthy coadjutor, the engineer, files up his pipe-wrenches, stocks up on fittings, and on the first kick he receives about lack of heat sarcastically advises the superintendent to buy flannel underwear and ulsters for every man in the works as being the best way out of it, and cheaper than burning $2.50 coal. So they sail in with the usual fall bluff that next season the heating system will be overhauled, and so forth, and so forth, and this winter we must get through as we did last. Every kick to the superintendent is passed on to the foreman, and he in turn ducks, dodges, and, himself blue with cold, sees that the engineer receives it. The planer hand believes that in order to save coal the engineer would allow them to suffer, and from personal experience I can say the entire force of employees quit speaking to the engineer, and he can't

get any machine work done without an order. I have had men cut me dead through such systems of heating, or systems of freezing, rather, when I was not to blame, as I was powerless to make changes.

I saw a different system last winter that may be of good to your readers. The building, originally three stories, was raised to seven stories and was rented with light, heat and power for manufacturing purposes. In the rebuilding the superintendent gave the heating question careful study, for the leases called for proper heat, and there was the coal pile looming up, one off-setting the other. The engine in the basement was just right if all the rooms were rented and the exhaust of course must be used, all of it, without back pressure.

Vacuum systems were the first thought and thorough study of the same was made. After looking the matter over carefully the superintendent decided on a radical departure from systems ordinarily used in factory buildings. Only exhaust steam was used, at or slightly above atmosphere pressure. The heater was of closed type. The exhaust pipe, 7 inches, ran through the center of the building to the roof, discharging through an ordinary exhaust head. In the new building the exhaust pipe ran straight from the heater to the roof, and was open to the air at all times, having no back pressure valve on it—in fact, no valve from the engine to the air. Under the ceiling of the top floor a T was put in the pipe, and then a nipple and valve led off from the exhaust pipe. This side line then dropped down through the building to the first floor, all of it being run 7 inches, the lower end having proper drain or return. From each floor 2-inch lines to headers were taken off, the usual side wall radiator being used. The returns, usually left straggling to any old point, were carefully looked after, all being at the basement united into two 2-inch pipes. There being no room to place a tank for the returns (room is money in a big city) a 4x4x6-foot pit was dug and cemented up under the floor. Into this the returns were run. On the top of the two pipes that dropped vertically into the above pit were placed T's with the ends looking up plugged. Through each plug was run a ¼-inch live steam pipe extending down, say, 3 inches, the whole forming a decent pipe ejector.

The above is the system complete, the operation of which leaves nothing to be desired. When steam is wanted in the fall of the year, the 7-inch valve is opened under the roof. Any floor desiring heat opens *their* valve admitting to their heating system. There are no valves on the returns. If the work is such as to require no heat, they shut off the valve to their system, while others may have all the heat required. In starting up the engine, the engineer steps to his ¼-inch ejector valves on the return terminals, opening them, say, one turn, which draws the steam on its way out to the roof into the system by the partial vacuum created. Note also that the entrained water comes down the system by gravity, and no traps are required. The system is an open circuit also, for if every floor shuts off steam the exhaust goes into the air as in summer. One may heat any one, all or none, and not bother anyone to run up to turn on or off. Simply open the 7-inch valve and tell each floor to turn on when they require heat and off when they don't. If it is desired to heat up in the morning so as to be warm by 7 A. M., start the engine, say, 6.30 A. M., and put on the ejectors. Of course, this is a factory building with hours from 7 A. M. to 6 P. M. and no night work in the leases; so no provision has been made for live steam at other hours, but one can readily see how easy it would be to have it.

As to the results of this system, as ample radiation was provided, no trouble to properly and comfortably heat has occurred. As to the coal pile, the only increase in the coal pile in January over July chargeable to heating was the live steam used by the two ¼-inch ejector supply pipes, and usually these were closed down to ½ turn and open for ten minutes after the engine was full loaded. So the coal pile results were "eminently satisfactory" to the old man. I have not seen a heating system used that for cost and results equaled the above. No back pressure, no traps; nothing in fact to get out of order; a positive circulation of the steam due to the steam jets, return water ready for use again, and, last but not least, no kicking at 25 degrees below zero.

I have stood on the roof of that building with the thermometer outside at 25 degrees below zero, and with full load on the engine. There was then practically no steam escaping from the exhaust head, showing the heating system was condensing all the exhaust. The steam jets induce circulation very quickly, and can be used easily on many poor systems. Of course, proper fall must be given and decently put up side-wall radiators, such as are commonly used. With a good circulation produced by the jets much better results can be made on existing systems. Try them for cold feet on a dead-end radiator.

DUPLEX.

A Difficult Case—What Should be Done?

Editor American Machinist:

A condition of affairs has recently been brought to my notice which would seem improbable, if not impossible, in any modern shop, but which is beyond question as I will state it. Being so at variance with the well-known views and teachings of the "American Machinist," you may perhaps think it of sufficient interest to lay before your readers.

The factory in the case, in the vicinity of New York city, employs from 600 to 800 hands in the manufacture of articles in every-day use, and does a large and apparently profitable business in a field where I should judge the competition to be quite close. This concern was in need of a foreman for the department making the metal trimmings for these articles, and a friend of mine secured the position. He found this department, employing about eighty hands, utterly without a system of any kind for keeping track of tools or work, the result of course being that things were in a state of chaos to all except four sub-foremen in charge of the various branches of the work in that department. He naturally started in with the intention of introducing some order and system; but he found himself hampered at once in his efforts in that direction by the aforesaid foremen, who soon made it evident that the existing state of affairs was the result of design and not of chance, and that they were determined to run the department without a foreman over them.

Upon proposing to one of them that he have an assistant, my friend met with the response: "Not on your life. Where do I get off with another man on the job? I'd soon get fired."

One in particular of these men was open in his expressions of contempt for the officials of the company, from the president down to the superintendent, embellishing his remarks with a choice selection of profanity. It soon became evident to my friend that some of these men must go if he stayed, and that it was merely a matter of time when matters would come to a crisis. "Well," I hear someone remark, "no difficulty in handling that situation; fire them out and put other men in their places." Very good advice, but right here was where my friend found himself "up against it." Aided by a "tip" from a friend in another department, he discovered the existence of a conspiracy embracing the four foremen previously mentioned, together with the engineer and the foreman of another department, by the terms of which they agreed to leave in a body in case of the discharge of any one of their number.

Upon making this discovery, my friend, having another good position open to him, decided to leave, and offered his resignation, which was declined by the president, who was also manager, and who asked for its reconsideration, and this being refused, invited him into the office, where he found the president, vice-president and superintendent, all others being excluded and the doors closed. The president endeavored in every way to alter his determination, offering him an increase in salary and other inducements, but to no purpose. Being pressed for his reasons for leaving, my friend laid before the meeting the exact state of affairs in the shop, offering to confront the parties singly or otherwise and confirm his statements.

The president, though not entirely un-

aware of the existing state of affairs, was furious, and was for accepting this offer, but was dissuaded by the others present. "Can't you fill these places?" he asked. "Undoubtedly," replied my friend, "but supposing that these six men leave in a body and you have others to step right into their places, which you have not, before your new men can get the run of things so as to turn out work in the required quantity, you will be obliged to shut down the entire works to let them catch up, and that means a loss to you of thousands of dollars."

The truth of these remarks could not be disputed, and after much fruitless discussion my friend terminated his connection with the company with the best of feeling on both sides, receiving an excellent letter of recommendation, and the expressed intention of the president to keep track of him, as he (the president) might want him again in the future.

Now, it seems to me that there is much food for thought and discussion in the above situation, and perhaps some of your correspondents will favor us with their ideas as to how it should be handled.

"NEEDLE."

Technical Publications.

The Department of the Interior has published a pamphlet extract from the mineral resources of the United States, entitled, "Iron and Steel at the Close of the Nineteenth Century," by James M. Swank. Besides a little general information about recent production, it contains a historical digest of the progress of the industry in the last three centuries which is interesting, although by no means as full as Mr. Swank's "History of Iron in All Ages," from which it is probably condensed.

"Electric Ignition for Gas, Gasoline and Oil Engines." By Harry B. Maxwell. Published by the Maxwell Engineering Company, Rome, N. Y. Price, $1.00.

This is a pamphlet in which the illustrations are the principal thing. They comprise working drawings of successful devices for both secondary, or jump sparker and primary, or hammer-brake sparker, which infringe no patents and are free to be used by all.

"Practical Electric Railway Handbook." By A. B. Herrick. 407 4½x6¾-inch pages, with 344 illustrations. The Street Railway Publishing Company, New York. Price $3.

This is a pocket book devoted to a single line of work in which its author is a specialist. Excellent judgment appears to have been used in the selection of the material, which is presented clearly and in a convenient form for ready reference. The book is well printed on fine paper and is well bound in leather, with a flap.

"Methods of Chemical Analysis and Foundry Chemistry." Seventy-nine 5x6¼ inch pages. By F. L. Crobaugh. Published by the Author, Cleveland, Ohio. Price, $1.50.

The increasing amount of attention which is being paid to chemistry in the foundry makes this a very timely book. The author has collected together and described in detail those chemical methods which seem best adapted to rapid work without sacrifice of accuracy. Methods are given for analyzing ore, pig iron and steel. The book is divided into two parts, of which the first is devoted to sampling and analysis and the second to the mixture of irons in the cupola in order to secure castings of the required properties.

"Proceedings of the Society for the Promotion of Engineering Education," Vol. IX. 348 6x9-inch pages. Engineering News Publishing Company. Price, $2.50; to libraries, $2.00.

The present volume strikes us as containing more of value than any of its predecessors. Among the more notable papers are one by Professor Crandall on, To What Extent Should Modern Languages be Required in Engineering Courses; one by Professor Jackson on, The Availability of Correspondence Schools as Trade Schools; two by Professor Allen and Mr. Kent, respectively, on, To What Extent Should Engineering Teachers Engage in Outside Work, and one by Professor Turner on Machine Work in an Engineering College.

"Electrical Catechism." By Geo. D. Shepardson. 390 6½x10-inch pages, with numerous illustrations. American Electrician Company, New York. Price, $2.00.

This is a book of very unusual character to appear in the question and answer form. Whatever may be thought of the merits of that method of treatment the present volume is one of the best examples of elementary scientific or technical literature that we have ever seen. It is intended for electrical workmen, engineers, dynamo tenders, etc. While the language is simple and non-mathematical, it is strictly scientific, and no better foundation for an education in electricity exists. The publisher has not done his part of the work in a manner to be commended. None of the illustrations are good and many of them are wretched. They are, in fact, entirely unworthy of the place where they are found.

"Francis Turbines." By Wilhelm Mueller. 372 7x10-inch pages. 214 illustrations and 16 plates of turbine installations in operation. Hanover, Germany: Jenicke Bros. $4.50.

This book is devoted mainly to the theory, design, construction and operation in service of the Francis turbine under varied applications and conditions, the second section being a review of the general development of the turbine in the seven leading countries. The description of design and construction of the guides and vanes is most complete and illustrated by fully dimensioned working drawings. The losses of energy in turbines are also fully discussed, and brake tests in comparison with a Jonval turbine are given. Most other kinds of turbines are fully described and well illustrated. The second part describes the development of turbines in Germany, Switzerland, Austria-Hungary, Italy, France, England and the United States, devoting considerable attention to Germany and Switzerland, but less to the others, concluding with a chapter on turbines at the Paris Exposition of 1901. The book is of great value to engineers interested in hydraulic power plans. The large type used and the numerous, very full and clear illustrations make it an easy one to read.

A riotous demonstration against the use of new shoe-lasting machinery recently occurred at Northampton, England. The operatives threw mud and stones at one of the manufacturers. Afterward they held a meeting and decided to strike if the factories persisted in using the labor-saving appliances.

A curious and interesting use for carborundum has been discovered by a London etcher, who, in experimenting with a number of substances, found finally, that the best etching point was made of carborundum.

Obituary.

Samuel H. Johnson died in Philadelphia, December 15, sixty-three years old. Mr. Johnson, who was a native of Ireland, is said by the Philadelphia "Ledger" to have operated a steam hammer in the main blacksmith shop of Cramps' shipyard more than forty years, and he was at his accustomed work the day before his death.

H. B. Underwood died in Philadelphia December 17, as a result of a fall on an icy pavement. Mr. Underwood had been for many years connected with the L. B. Flanders Machine Works, being at first their outside man and having charge of the work of repairing engines in and around Philadelphia, especially the work of boring cylinders in place, etc. Finally he organized the firm of H. B. Underwood & Co., which continued the business with Mr. Underwood at its head. Associated with him was D. W. Pedrick, formerly of the Pedrick & Ayer Company, who informs us that he will now return to active work and will continue the business. Mr. Underwood met with a severe accident about a year ago. While alighting from a trolley car a runaway horse struck him and injured him severely, and it is probable that the effect of this first accident made the last one more serious than it would otherwise have been.

New Corporations.

Steel Machine Co., 31 South Broad street, Woodbury, N. J.; object, manufacturing printing presses, etc.; capital, $60,000. Incorporators: H. Brown Green, Geo. G. Green, Wm. Johnston and Wm. G. Johnston.

Bryant Manufacturing Co., Corporation Trust Co., 15 Exchange place, Jersey City, N. J.; object, manufacturing iron, steel, etc.; capital, $1,000,000. Incorporators: Howard M. Carter, John I. Billings and K. K. McLaren.

New Catalogs.

We have in hand a copy of the president's report for 1900-1901 of Cornell University. It is rather a portly little volume and treats of many matters of current interest pertaining to the University as a whole and by departments. Size, 5¼x7¾ inches.

Brownell & Co., Dayton, O., have published engine catalog No. 50, superseding all previous issues. It shows the Brownell Twentieth Century engines, of the automatic, self-contained and center crank types; a line of slide-valve engines and tubular boilers. The catalog is 9x6 inches, standard size.

The Cincinnati (O.) Planer Company has just brought out a 1902 issue of its catalog, showing its standard line of planers from 24 to 60 inches, also its special widened planers and electrically driven planers. The pamphlet is neatly executed and contains thirty-two pages of 9x6 inches, standard size.

The American Machinery Company, Grand Rapids, Mich., has sent us some publications illustrating its "Oliver" universal saw bench, made in various sizes, and its "Oliver" wood trimmer for trimming off pieces of wood in angular forms. The range of operation of the latter is graphically illustrated by charts.

The Hoshor Platt Company, 15 Cortlandt street, New York (home office, Paterson, N. J.), has published a catalog of industrial railways. It relates to track, export track, crossings, turntables, cars, electric locomotives, etc., and contains quite a little information about tractive force, etc. Size, 8x10½ inches.

We have received from the New York office of the Brown Hoisting Machinery Company, of Cleveland, O., a pamphlet devoted to "Brownhoist" locomotive coaling stations. It describes new methods of coaling locomotives, originated by the company, and gives pictures of a plant designed and built by them and now in operation. The pamphlet is well executed and is 12x9 inches, standard size.

The Hoppes Manufacturing Company, Springfield, O., has published a new catalog illustrating its live steam feed water purifier, standard exhaust steam feed water heater, new cast-iron feed water heater and method of connecting feed water heaters by means of its new induction chamber, also its steam separator and oil eliminator and its new cast-iron exhaust head. Size, 8¾x5¾ inches.

We have received a catalog of the Speed Changing Pulley Company, 750 East Washington street, Indianapolis, Ind. Its leading contents is a series of views of standard machine tools, showing the self-contained speed-changing pulley as used in connection with each—usually on the countershaft, but in the case of the shaper directly attached. The application to an engine governor is also shown. The pamphlet is 7x10 inches.

The Bristol Company, Waterbury, Conn., is getting out a new series of catalogs of its recording instruments. One of these, No. 5, which has been received, is a list of recording pressure and vacuum gages for all uses and ranges of pressure. Another, No. 6T, comprises recording thermometers for all classes of temperature measurements up to maximum ranges of 800 degrees Fahr. These pamphlets are 9½x11¾ inches. They will be mailed free by the company to any reader.

The fifth edition of the machine tool catalog of the American Tool Works Company, Cincinnati, O., is at hand. It is a business-like publication of a pocket size (4¾x6½ inches) and contains 496 pages. It illustrates the company's well-known line of tools—lathes, planers, shapers, milling machines, upright and radial drills, boring and turning mills, screw machines, turret lathes, bolt cutters, screw slotting machines, two-spindle valve milling machines, cock grinders, chucking lathes, pulley lathes, etc.

We have received from E. Sonnenthal Junr. 6, Neue Promenade, Berlin, Germany, his latest catalog of machine tools, small tools, etc. To say that this book contains 914 pages is to indicate the extent of the field elaborately covered by its contents. A general line of machine tools is included—although Mr. Sonnenthal publishes a special catalog of large ones—and there is an assortment of presses, punches, shears and the like, as well as special machinery. The catalog is chiefly notable for its great variety of minor machines, tools, appliances and supplies for shop use. In a few cases the names of the manufacturers are given—we notice, for instance, Cleveland twist drills. The book is bound in crimson cloth; size of page, 4x6 inches.

Miscellaneous Wants.

Advertisements will be inserted under this head at 25 cents a line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Caliper cat. free. E. G. Smith, Columbia, Pa.

Gear Wheels, gear cutting. Grant; see p. 24.

Punches & dies. Wal.M.Wks.,Waltham,Mass.

Eye Benders. Estep & Dolan, Sandwich, Ill.

Fine machine and experimental work. The Des Jardins Type Justifier Co., Hartford, Ct.

Light and fine mach'y to order; models and elec. work specialty. E. O. Chase, Newark, N. J.

Book "Dies and Diemaking," $1, post paid. J.L.Lucas,Bridgeport,Ct. Send for index sheet.

F. J. Stokes Machine Co., 13th and Noble sts., Philadelphia, Pa., build light machinery.

Selden Packing for Stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., New York.

Special tools, models, fine light mach'y and foundry work wanted. Murray Mfg. Co., Richmond Valley, Staten Island, N. Y.

A middle-aged man, with 18 years' experience in the office and selling end of a manufacturing business, wishes to purchase an interest in and associate himself with a small manufacturing business. Box 316, Am. Mach.

Purchaser for small manufacturing plant: lot, 100x180 feet; machine shop, 32x68, two story, with line shaft and gasoline power; foundry, 40x54, new modern equipment; good location; for sale cheap. Hart-Parr Co., Madison, Wis.

A thorough machinist, with good shop located in southwestern Ohio, would like to correspond with the object of making permanent contract to build medium weight machinery; those having established trade preferred. Address Box 314, American Machinist.

$35,000 extra capital wanted in an old-established New York city mill-supply business; chance of the century for mechanic or hardware man; partner retiring on account of extreme age; others will remain if wanted. Address "Opportunity," care Amer. Mach.

Institutions retiring from business having machine tools, brass and wood working machinery will find it to their interest to correspond with us. We purchase complete plants or handle them on com. C. C. Wormer Mach. Co., 55-59 Woodbridge st., W., Detroit, Mich.

The annual meeting of the stockholders of the American Machinist Press, for the election of five directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the office of the company, No. 218 William st., in the city of New York, on the 13th day of January, 1902, at 12 o'clock noon.

A. Leighton Donnell, Secretary.

Wants.

Situation and Help Advertisements only inserted under this head. Rate 25 cents a line for each insertion. About six words make a line. No advertisements under two lines accepted, and no advertisements abbreviated. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded; but replies will not be returned. If not forwarded they will be destroyed without notice. Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents.

Situations Wanted.

Draftsman with experience wishes position. Box 311, American Machinist.

Blacksmith, a first-class tool-dresser, desires change, within New England. Box 310, American Machinist.

Draftsman, capable designer and experienced patternmaker, desires change. Box 307, American Machinist.

Experienced draftsman, 23, desires position with manufacturer of machinery. Box 287, American Machinist.

Mechanical engineer, technical graduate, 10 years' experience, desires position; best references. Box 312, American Machinist.

Competent draftsman wants position; technical graduate; light complicated machinery preferred. Address Box 302, Amer. Mach.

Position as traveling salesman for a tool or machinery firm, by a first-class toolmaker and mechanic; best of references. "Salesman," care American Machinist.

Young man, of good executive ability, desires position as foreman of machine shop; up to date in improved methods of handling work; references. Box 303, Amer. Mach.

Up-to-date superintendent seeks position of responsibility, experienced on engine, electrical, machine tools, automatic machinery; A1 references. Box 313, American Machinist.

A practical superintendent or general foreman, of 20 years' experience in up-to-date machine shops, expert in tools, dies and jigs, open for engagement January 1, 1902. Box 288, American Machinist.

Mechanical engineer, with practical experience, graduate of Polytechnical School at Stuttgart, Germany, desires position as draftsman; available about January 20, 1902. Address C. W., care American Machinist.

Bookkeeper, age 30, single; thoroughly experienced in manufacturing line; up-to-date methods; all-around man; capable of taking charge of office; exceptional references; salary required, $20 per week. Box 305, Am. M.

Mechanical engineer, Stevens graduate, 17 years' experience, good executive and designer, desires to change about February 1; specialties, automobile construction, steam and gasoline, also small interchangeable work, typewriters, etc. Box 306, American Machinist.

Position as milling machine foreman, by a technical, practical and experienced mechanic on medium size work; well up in designing jigs, cutters, devices, etc., for the rapid milling of interchangeable parts in quantities, also cam and gear cutting and modern universal milling practice in general. Address "Energetic." Box 304, American Machinist.

Help Wanted.

Machinists to sell my calipers, etc.; big inducements. E. G. Smith, Columbia, Pa.

Wanted—In printing press works, draftsman and tracers; state experience and wages required. P. O. Box 604, Plainfield, N. J.

Wanted—First-class wood pattern makers, machinists and toolmakers, experienced on valves and fittings. Address Box 309, Am. M.

Good patternmakers, both wood and metal, desiring steady employment, will find it to their advantage to apply to the General Electric Co., Schenectady, N. Y.

Wanted—Number of patternmakers, experienced on compressor or steam engine work; none others need apply. Franklin Air Compressor Co., Franklin, Pa.

Wanted—A first-class mechanical draftsman; one familiar with automatic machinery preferred; state age, experience and salary. Box 300, American Machinist.

Wanted—Immediately, an electrical draftsman, experienced in motor and generator work; state in detail previous experience and salary expected. Address L. A. S., care A. M.

Experienced draftsman wanted on mill machinery and machine tools. Permanent em-

ployment assured to rapid and accurate draftsman. Bethlehem Steel Company, South Bethlehem, Pa.

Wanted—A number of mechanical draftsmen on iron and steel works machinery, furnaces, etc. Apply to Chief Draftsman, Mechanical Department, Pennsylvania Steel Company, Steelton, Pa.

Wanted—A machine shop foreman to take charge of a shop employing about 75 men, building steam hammers and special machinery; a good place for a live, hustling mechanic. Box 286, AMERICAN MACHINIST.

Wanted—Advertising man, of good address, capable of handling engineering and mechanical advertising in technical papers, preparing catalogs, etc. Address, stating salary expected, experience and reference, L. L. Cline, Detroit, Mich.

We are enlarging our works, and will shortly require an increased number of skilled mechanics; we invite application from pattern makers, molders and machinists. Address the Westinghouse Machine Company, East Pittsburgh, Pa.

Wanted—Experienced and practical man as foreman of a machine shop making fine steel and brass goods in general; must be able to handle about 20 men to best advantage; state experience and wages wanted. Address Box 315, AMERICAN MACHINIST.

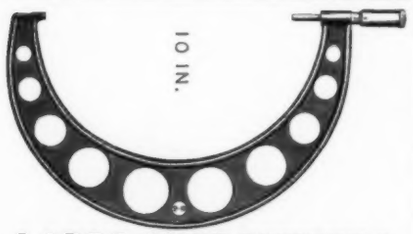
Wanted—Foreman for a small shop manufacturing transmission machinery in the South; a man well up in the manufacture of iron pulleys, hangers, etc., will find a permanent position; give references and state experience. Box 296, AMERICAN MACHINIST.

Wanted—A thoroughly competent mechanical engineer to take charge of drafting room of a concern manufacturing a full line of mining machinery, except steam engines and boilers. Address, giving full information as to past experience, references and salary expected. Address "Mining," care AM. MACH.

A MICROMETER WATCH CHARM

Made of 14-K extra heavy gold filled and will wear for twenty-five years. The measuring points are of 10-K solid gold. It will measure all sizes less than three sixteenths accurately in thousandths of an inch. Mailed to any address in a miniature leatherette case on receipt of $2.50.

Patent applied for. **STERLING WATCH TOOL COMPANY,** Send for circular. **Rochester, N. Y.**



LARGE MICROMETERS.

We now carry in stock a full line up to 12". Prices on the large sizes have been greatly reduced. Better drop us a postal card for latest Catalog to-day.

J. T. Slocomb & Co., Providence, R.I.

Chas. Churchill & Co., London, Birmingham, Manchester, Glasgow.

For Sale.

American Patent to be sold to a first-class firm, by which various new and profitable machine tools can be brought on the market.

Address Richard Brass, Nurnberg, Germany.

Our Little Bench Tapper Is a Great Tool.

Taps 10,000 holes with a No. 2 Tap, or 6 000 with a No. 12, to bottom, ¼ in. deep in ten hours. Doesn't break taps and you don't have to drill clearance. Friction driven and has countershaft. Better write.

Fulton Foundry & Machine Company

21 Furman St., Brooklyn, N. Y.

WALKER'S CELEBRATED

CALIPER ATTACHMENT

Constitutes 3 Tools in one, and is a time-saver for the

MECHANIC AND MACHINIST.

Illustrated Booklet Free.

WALKER TOOL CO. Milwaukee, Wis., U. S. A.

Station "A"

First-class, all-round tool and die maker and light machinist for all kinds of tools, dies, fixtures and experimental work; must be capable to invent, design and develop new ideas and take charge of several other toolmakers; small shop near New York, doing stamped and turned work. Address, giving age, experience and wages expected, Box 301, AMER. MACH.

Wanted—Foreman for a brass department containing 50 hands, in a large electrical factory; must be familiar with parts of electrical apparatus and with modern methods of production and know the entire details of the workings of such a department. Apply, giving full particulars as to experience, salary expected, etc., to Box 258, AMER. MACHINIST.

A Good Boring Tool using Inserted Self-Hardening Steel Cutters.

Made in 5 sizes. Diam. bars, 9-16 in. to 1 11-16 in. We guarantee this tool to be as stiff and to take as heavy a cut as any forged tool of same size, and as it will take the place of about one dozen forged tools the great economy effected by its use can readily be seen.

Write for catalog

ARMSTRONG BROS TOOL CO.

(The Tool Holder People)

CHICAGO, ILL., U. S. A.

HENRY CAREY BAIRD & CO.,

INDUSTRIAL PUBLISHERS, BOOKSELLERS AND IMPORTERS,

810 WALNUT ST., PHILADELPHIA.

☞Our New and Revised Catalog of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogs and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

Special Machinery

Having a large machine shop and foundry equipped with modern tools, we are in a position to build special machinery, large or small, in the shortest possible time, and solicit plans and specifications.

The Watson Machine Co.,

Established 1850.

Paterson, New Jersey.

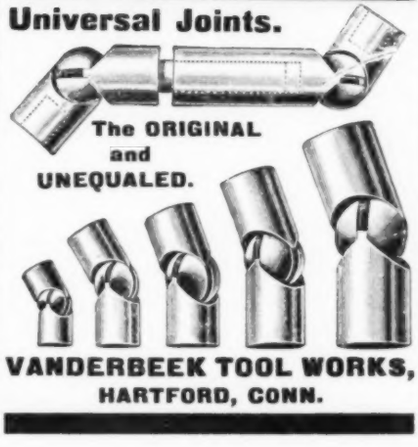
New Gear List on application.

If you want GEARS cut absolutely correct, send them to

NAZEL MACHINE WORKS

1046 Ridge Ave., Philadelphia.

Universal Joints.



The ORIGINAL and UNEQUALED.

VANDERBEEK TOOL WORKS,

HARTFORD, CONN.

Manufacturers.

The Watchung Silk Company, Plainfield, N. J., will erect a new factory.

The Texas State sugar mill which will use convict labor is said to be "in sight."

The Chicago (Ill.) Coated Board Company will locate a plant in Haverhill, Mass.

The Abram Cox Stove Company, Philadelphia, is enlarging its Lansdale, Pa., plant.

The Consolidated Ice Company, Pittsburgh, Pa., will erect a plant at a cost of $150,000.

The American Machine Company, Louisville, Ky., is about to build a two-story machine shop.

A 100x200-foot foundry, to cost $25,000, is being built by the R. M. Eddy Foundry Company, Chicago, Ill.

The directors of the Newmarket (N. H.) Manufacturing Company, textile goods, have voted to build a new mill.

The Mengel Box Company, Louisville, Ky., has secured a permit for the erection of a $40,000 three-story factory.

The screen door and stove board plant of the Wabash Screen Door Company, Rhinelander, Wis., has been burned.

The Forrester Plaster Company, Cleveland, O., proposes to construct extensive new mills in the vicinity of Port Clinton.

Landers, Frary & Clark, manufacturers of hardware, New Britain, Conn., will build another addition to their factory.

Minchener & Henderson, manufacturers of spokes and handles, Troy, Ala., are to locate a large factory in West Huntsville.

The Rusden Machine Company, manufacturer of bleaching and dyeing machinery, etc., Warren, R. I., will build an addition.

Improvements, comprising new buildings, machinery, etc., will be made at the Parkersburg (W. Va.) Ice Company's plant.

It is reported that the New England Watch Company, Waterbury, Conn., is having plans drawn for an addition to its factory.

A factory building is to be erected for the Booth Manufacturing Company, manufacturer of patent porch columns, Detroit, Mich.

Stearns & Castor, Philadelphia, Pa., are to receive bids on an addition to Meerbach & Snyder's foundry at 1610 Vandyke street.

The A. M. Collins Manufacturing Company, cardboard, etc., American and Oxford streets, Philadelphia, Pa., will build an addition.

The Mann Edge Tool Company, Lewistown, Pa., will erect a new factory and more than double the present capacity of the works.

In the spring the Chandler Pump Company, Cedar Rapids, Ia., expects to build a new foundry, 200 feet long, at a cost of about $25,000.

A company is being organized at Saginaw, Mich., with the intention to build a starch factory. Harry N. Hammond is at the head of it.

There is a project to build at Pell City, Ala., a cotton mill to cost $600,000. George W. Pratt, of Atlanta, is president of the company.

Work is progressing on the foundations of factory buildings and shops for the Hecla Portland Cement & Coal Company, Bay City, Mich.

The Womroy Brothers, of Graham, N. C., will build a cotton mill. The material is being purchased. The capital stock is to be $100,000.

An addition is to be built to the factory of the Hinde & Dauch Paper Company, manufacturer of wrapping and corrugated paper, Sandusky, O.

The Simpson Stove & Manufacturing Company, Pittsburgh, Pa., has had plans prepared for a plant at Canonsburg, the buildings of which are to cost $50,000.

The Birmingham (Ala.) Railway, Light & Power Company will build a car barn, also a machine shop in which fifty cars can be placed for repairs at one time.

The A. M. Collins Manufacturing Company, Philadelphia, Pa., has purchased land upon which, it is said, the company contemplates building another paper factory.

The New York Kerosene Oil Engine Company has purchased land at College Point, N. Y., where it will erect a factory for building launches, yachts and working boats.

Work has been commenced on the erection of an addition to the plant of the Pittsburgh Meter Company at East Pittsburgh, Pa. The meter company is a Westinghouse interest.

A building permit has been issued to the Winchester Repeating Arms Company to erect a brick addition on Newhall street, New Haven, Conn., the cost to be about $7,000.

The Ayer & Lord Tie Company, of Chicago, proposes to establish a factory for treating ties and posts, which will have a capacity of 8,000 ties daily and will employ 200 men.

The Materne Manufacturing Company, steam and hot water heating, St. Louis, Mo., is building a two-story factory building at 800 to 810 South Eighteenth street, to cost about $15,000.

A Minneapolis, Minn., building permit has been issued to the J. L. Owens Company, manufacturer of grain-cleaning machinery, for a three-story warehouse and factory, to cost $10,000.

It is announced that a large glass works will be built in Long Island City. The head of the project is C. H. Tiebout, of the firm of C. H. Tiebout & Sons, hardware dealers, 31 Grand street, Brooklyn.

Owing to large orders from the Rock Island and the Pennsylvania Railroads, an addition is to be made to the Anderson & Depuy plant at McKees Rocks, Pa., now a part of the Crucible Steel Company of America. This increase is in the car spring department.

G. W. Smith, of Warsaw, N. Y., and H. M. Burch, of Castile, have formed a company to manufacture and handle the Stuart & Woodman electric lighting conductor. The factory will be located at Warsaw. The company has acquired the right in seven States, including New York.

The Abbott Electric & Novelty Company (capital, $60,000), which is installing its new plant at Warren, O., has organized, electing H. H. Hammond, of Cleveland, president; E. L. King, of Warren, vice-president; W. J. Peck, of Warren, secretary, treasurer and superintendent.

The Herman Mayer Manufacturing Company, school supplies, Detroit, Mich., has been succeeded by the firm of Herman Mayer & Co. They will manufacture a device for teaching the rules of arithmetic. The machine is about 3 feet square and is composed of wood and metal.

Application has been made for a charter for the Duquesne Malleable Iron Company. The company will probably build a plant near Pittsburgh, Pa. The incorporators are E. J. Frauenheim, C. A. Fagan, Leopold Vilsack, W. A. Magee, Jr., and Charles T. Moore. Fagan & Magee are the attorneys.

An enterprise for the establishment at Port Vincent, La., of the largest brick, tile and sewer pipe plant south of the Ohio and Potomac is headed by the following persons: S. J. Stubbs, F. B. Stubbs, W. A. Jeter, D. W. Jeter and H. N. Fagin, all residents of Macon, Ga. Preliminary arrangements have been made at the Grunewald Hotel, New Orleans.

Steel Castings.

High Grade Crucible Steel Castings Delivered

In Just Five Days

From receipt of patterns. We cast Shoes, Stamping Dies, etc., in any shape required, of Tool Steel, fully equal to any forging. Ready to prove it. Book free.

Uniform Steel Co., NEWARK, N. J., U.S.A.

OHIO STATE UNIVERSITY, COLUMBUS, College of Engineering. Nine four year courses leading to Engineering degrees. Three short courses. Total expense, including all fees, board, room and books, may be under $300.00. Many students are self-supporting. Credit given for shop and drawing room experience. Catalog on application to executive office.

VALUABLE BOOKS.

COMPRESSED AIR,
Its Production, Uses and Applications.
By GARDNER D. HISCOX.
Large Octavo 820 Pages. 545 Illustrations.
Bound in Cloth, Price, $5.00.
Half Morocco Binding, Price, $6.50.

Mechanical Movements, Powers, Devices and Appliances,
By Gardner D. Hiscox. **Price, $3.00**

Horseless Vehicles, Automobiles and Motor Cycles,
By Gardner D. Hiscox. **Price, $3.00**

The Modern Machinist,
By John T. Usher. **Price, $2.50**

"Shop Kinks." A Book for Machinists.
By Robert Grimshaw. **Price, $2.50**

Gas Engine Construction,
By Parsell & Weed. **Price, $2.50**

Liquid Air and the Liquefaction of Gases,
By Prof. T. O'Conor Sloane. **Price, $2.50**

Gas, Gasoline and Oil Engines,
By Gardner D. Hiscox. **Price, $2.50**

Complete Electrical Library (5 volumes),
By Prof. T. O'Conor Sloane. **Price, $5.00**

Inventor's Manual, How to Make a Patent Pay,
New, revised and enlarged edition. **Price, $1.00**

Saw Filing and Management of Saws,
By Robt. Grimshaw. **Price, $1.00**

FREE A special descriptive circular of any of these books sent on request. Our 96 page catalog of scientific and practical books, sent free to any address in the world on request.

NORMAN W. HENLEY & CO., Publishers.
15 Beekman St., New York.

CLEVELAND GEAR WORKS

W. R. SAWYER, Lessee.
86 Seneca Street,
CLEVELAND, OHIO.

Gear Wheels and Gear Cutting
of all descriptions.

Get Our Prices.

THE GREATEST CONVENIENCE

of adjustment is offered by our **Swinging Cover Enclosed Arc Lamp** to the novice as well as the skilled electrician.

Tools are unnecessary.

Mechanism Simple, Accessible, Durable.

Economical in operation.

Voltage 110 to 500.

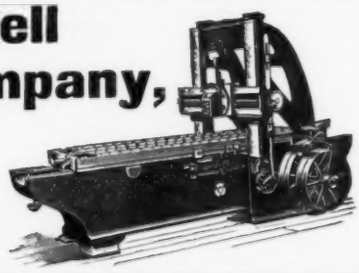
Prices Low.

SEND FOR CATALOG.

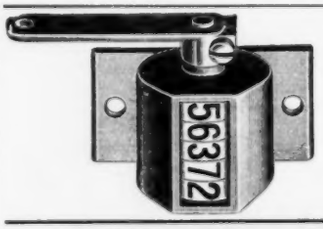
Lea Electric Mfg. Co.,
Box 1234, ELWOOD, IND.

Woodward & Powell Planer Company,

WORCESTER, MASS.



U. Baird Machinery Co., Pittsburgh, Pa.
Parke & Lacy Co., San Francisco, Cal.
Robinson & Carey Co., St. Paul, Minn.
Manning, Maxwell & Moore, Chicago, Ill.
Manning, Maxwell & Moore, New York City.



Ratchet & Rotary Counters

for voting machines, nickel-in-slot machines and automatic machinery generally, to register number of pieces or quantity produced—for any purpose requiring a small, light and accurate instrument.

THE VEEDER MFG. CO., Hartford, Conn.

Makers of Counters, Cyclometers, Odometers, Fine Castings.

CRANE VALVES

ESTABLISHED 1855